

LETTERS

CONCERNING

MIN D.

To which is added, A SKETCH of
Universal Arithmetic;

Comprehending the
DIFFERENTIAL CALCULUS,
And the
Doctrine of FLUXIONS.

ΦΡΟΝΗΣΕΩΣ ΚΡΗΔΕΜΝΟΝ.

*By the late Reverend Mr. John Petvin, A. M.
Vicar of Ilfrington in Devon.* *K*



L O N D O N :

Printed for JOHN and JAMES RIVINGTON,
in *St. Paul's Church-Yard.*

M D C C L.

LETTERS

CONCERNING

M. V. W. D.

To which is added A SKETCH OF

Universal Arithmetic;

Comprehending the

ESSENTIAL CALCULUS,

And the

Doctrine of FLEXIONS.

JOHN HENRY KIRKMAN.

By the late Reverend Mr. John Brown, A.M.
Master of Hingham in Devon.



LONDON:

Printed for John and James Rivington
in St. Paul's Church-Yard.

MDCCL.

*Case
1876*



P R E F A C E.

*T*HE Intention of the Author of these Papers was, to have left behind him a Treatise on the Subject of Mind, or Intelligence; but ill Health prevented him from putting his Design in Execution. His Friends, therefore, could not but think it their Duty to communicate to the World the following Letters, which contain his Sentiments on this Subject; tho' the Manner in which he himself would have introduced them to the Public, might have made them appear to better Advantage.

They were first written in Short-hand, and, being all transcribed from the original Characters, have since been corrected by a Gentleman highly esteemed by the Deceased, and well skilled

skilled in all Parts of Polite Learning, and Science, but especially in that Chief Science which relates to Mind: They who are at all versed in this kind of Literature, will easily recognize, under this Character, the Author of a Book called Three Treatises. And it would be ungrateful not to make this public Acknowledgement, that these Letters would not have been so correct, as they now are, without the Friendship and Assistance of this Gentleman.

To the Letters is added a Sketch of Universal Arithmetic, comprehending the Differential Calculus, and the Doctrine of Fluxions.

*If the Perusal of these Papers may in some degree be useful towards discovering the * Philosophical Arithmetic (lost for Ages), and reducing the Science of Mathematics to its primitive Purity and Simplicity, there needs no Apology for making them public.*

* Plat. Phileb.

LET-



LETTERS

CONCERNING

MIND.

LETTER I.



YOU are certainly in the right in continuing *the Exercise of your Thoughts.* To have right Thoughts of Things, and to communicate those Thoughts to others, is the *Whole Part* we have to act on this Stage of the World; and these Two Things are very closely united.

B

To

This prim

To have right Thoughts of Things, we must study ourselves, and *other Men*; and the Knowledge of ourselves, and other Men, furnishes us not only with *Matter* for our Thoughts, but with the *Method of communicating* them; For we must proceed from their *present* to *that* Sense of Things to which we would bring them. 'Tis this which makes the Beauty of all Writing and Conversation; and, if we can represent Truth in a natural Way to ourselves, we shall of course fall into the true Method of representing it to others. It seems probable, that *Socrates*, tho' he published no Writing, must, as he was an eloquent Man, have writ much for his own Use, and perhaps in the very Manner of *Plato's* Dialogues.

To write out our Thoughts sometimes, such as they are, even when we are not satisfied of their Truth and Clearness, would, without Question, be of great Use. We should

most certainly, by this means, better see what they are. Mr. *Locke*, in his posthumous Works, somewhere lays great Stress on this; and this was the constant Practice of *Monf. Bossu*: When any thing came in his Way which he did not understand, he immediately put his Pen to Paper, and would not leave off writing, till he had cleared up the Point. This was a very brave Resolution, under a proper Regulation, if he had the Skill to make a Distinction between such Difficulties as required Days and Weeks to clear up, and such as required Years: But this Skill, I doubt, he was not Master of; few, very few, are capable of making this Distinction.

In Subjects that we understand well enough in the main, we are apt to be too careful and solicitous about writing well; and this gives us no small Pain, especially when our Case is such, that our Talent in Writing

comes short of our Taste: But this Severity is certainly very absurd. Among a Croud of Thoughts and Expressions, that present themselves to a Man of any tolerable Genius, it is impossible, as they lie in the Mind, to make choice of such as are best: The right Method, therefore, is, after using a certain Measure of easy Thought and Reflection, to throw immediately on Paper the Result of such Thought and Reflection; and then, when this is done, to exercise our Judgment freely and easily upon it: For, if we write out our Thoughts upon the same Subject but a few times, and as often correct our Writing according to our best Judgment; most certainly what we wrote out the last time would be much more correct than any Composition we could pretend to form in our Head, and write out but once.

If we will not suffer our Pen to move a Step without Thought and Re-

Reflection, our Writing must of Necessity be stiff and formal ; but, if we give our Genius more Liberty, and practise much in the Manner I have been mentioning, our Composition will then become as *easy* and *free* as *Nature herself*, and at the same time be *exact* and *just*, according to the Rules of *Art*. GOOD WRITING is like GOOD-BREEDING ; the Motions of both are according to *general Rules*, derived from *particular* Observation. But they are not accompanied with *Deliberation* or *Reflection*, as if we thought whether we were going to move right, or no ; that Matter has been before determined. And when, by repeated Practice, we have been accustomed to move, on the *first* Thought, according to such Determination, our Motion is become natural and free, and will seem so very easy to an injudicious Spectator, that, however incapable, he will think he can do the

B 3

same.

same. 'Tis certainly a Barbarian Notion, That following of Rules well can cramp our Genius.

The regular and artful Works of ingenious Men, we are apt to imagine, were composed one Part after another from the Beginning, as they stand in their Books ; as if they began just as we begin, and wrote as we read, one Thing after another : And when we ourselves compose, we are apt to cut out our Work, and go to it in the same formal Way ; but, as regular and methodical as Father *Bossu's* Piece of Epic Poetry may seem, there was not at first a Thought of such Method and Regularity : It was all writ by Scraps, and afterwards pieced up together in the Form it now appears in, as the Writer of his Life expressly tells us.

But enough of this.

I am very much inclined to think my Expectations of finding HOMER a Master of *Eloquence* will be answered, when

when I have Leisure to look over his Speeches: But for yourself at present, I believe it would be much more useful to take those of *Xenophon*, and indeed to study the personal Character of *Xenophon* himself. In his *Anabasis* particularly, you find him a young Man, as you are yourself; but as to his own History, if you have not inquired into it, I will at another time give you some Account of what I have observed of it. What I would by all means recommend to you at present, is, to compare the Character of *Xenophon* (as you can collect it from his *Anabasis*) with the Character of *Cyrus*, as you have it in his *Cyropædia*, and with the Character of *Agésilas*, as you have it from *Plutarch*, as well as from *Xenophon*. This Comparison will, if I mistake not, help much to give an Idea of TRUE POLICY, or *the Art of living among Men*, as it was understood and practised by the Antients: This will be

Xenophon

→

of more Use to you at present than Metaphysical Speculations; and this I say at the same time that I could heartily wish you had a little more of that Sort of Knowledge. I am sensible that it would be of great Use to you, though I am persuaded not as great as the former. This I can assure you; in what I have been writing, I have had a very great Regard, and I sometimes thought too great, to what *Xenophon* relates of *Socrates*, with respect to *Euthydemus* *.

Perhaps I may venture to say, that hardly any Man has ever known experimentally more of these *ωδίνες*, nor has had Occasion for more Patience; and, from a Sense of what I have felt, I have been willing to save you some of those Pains. All Men, that would be good for any thing, must necessarily feel these *inward* Pangs; and it is the great Art of Philosophy to raise and to manage them.

* *Xen. Mem. l. 4. c. 2.*



LETTER II.

BEfore I come to the Numbers, or other Things, I was to write to you about, some time after you were come to *London*, I can hardly forbear expressing my Surprize, How it is that the old *Samian* has taken his Turn again in the late Earl of *Shaftsbury*. 'Tis a Myſtery, I muſt own, to me; and perhaps I am too great a Stranger to the State of Learning, as it is, and has been, in our modern World, to be capable of accounting for it. However, it ſeems to be Fact; and whatever Reasons this Author might have for his Backwardneſs in owning it, I cannot think he was at the Bottom unwilling to have it ſo underſtood. Why does his principal Character make his firſt Appearance with *Virgil*

gil in his Hands but for the sake of introducing afterwards, where his Character is coming on, THE ACTIVE MIND, &c.

That remarkable Averſion, breaking out in the Perſon of the *Sceptic* againſt this Philoſophy, juſt as it had been ſo handſomely addreſſed to him upon the Bottom of his own Principles, may indeed be ſaid to be intended only as a Satire againſt thoſe who ridicule, or make light of it. But then it muſt be allowed at the ſame time, to diſcover the Author's real Sentiments more effectually than any direct Language could have done. And as for his CHIEF SCIENCE, as he calls it (in the Language of *Plato* μέγιστον μάθημα); This, where he comes to recapitulate, he ſcruples not to ſay, is acquired by the Study of MIND; to which he goes on to animate his Reader; tho' by a ſudden Tranſition, he thinks fit to give a Check to the over *ambitious Purſuit*.

Now,

Now, MIND, 'tis evident, is likewise the grand Subject of Inquiry with *Pythagoras*, as 'tis, indeed, the Point to which, as to a Center, the Labours both of *Aristotle*, and *Plato*, in a great measure tend.

As for *Xenophon*, he has, in Appearance, no more to do with this sort of Learning than our *English* Noblemen. As in Physics, he goes no further to find a Deity, than he may be followed by the most ordinary Capacity; so, for a further and more satisfactory Idea, he would seem to be more beholden to the Religion of his Country, than to Metaphysics. In short, he seems to have been as little struck with the fine Things of the *intelligible*, as of the *sensible* World. And yet, notwithstanding all this, when every Object of Admiration in the Arts and Sciences, as well as in other Things, shall be weighed in the Balance of Righteousness; I know not whether he may not appear to have

have done *Socrates* as much real Honour, as *Plato* himself, or even as *M. Fontenelle*, in his higher Strain of Panegyric, may have done our wonderful Sir *Isaac Newton*. In the Symposium, as well as *memorable Things*, *Socrates* has no contemptible Character; nor can I think, the Author had the least Apprehension he should make it less, by dropping the following Words, * "Ἀρ', ἔφη, ὦ Ἄνδρες, εἰκός, ἡμᾶς παρόντι Δαίμονι μέγας, καὶ τὰ μὲν χρόνῳ ἰσότητι τοῖς αἰγετέσι θεοῖς, τῇ δὲ μορφῇ Νεωτάτῃ, καὶ μεγέθει πάντα ἐπέχοντες, ψυχῇ δὲ Ἀνθρώπων ἰσχυμένῃ, Ἐρωί, μὴ ἀμνημονῆσαι. But I am not Critic enough to judge, whether the Text, where it speaks of the Soul of this great Genius, as being equal to that of Man, may not want to be corrected. 'Tis a Language, I doubt, which would not sound well in Sir *Isaac Newton's* Ears: For tho' Sir *Isaac's* Character of God, as entirely like himself, may seem to agree with

the

* *Xen. Symp.*

the *μνοειδής* of *Socrates*, in the *Symposium* of *Plato*, and in adding the Words, *all Eye, all Ear, all Intelligence*, he may seem, like the same *Socrates*, in his more grave and plain Discourse with *Aristodemus*, to join *Sense* and *Intelligence* every-where in his amazing Sensorium; yet as he adds further, *But This is in a Way not at all like Man, in a Way utterly unknown to us*, he should seem to have a more holy Idea of the Deity, than can be pretended to be suggested any-where by *Socrates*, or any of the greatest Antients *. And here, by the way, I should think one need go no further to defend Sir *Isaac* against the invidious Charge of making no more of the *Supreme Being*, than the *Anima mundi* of the Antients, or even of taking his Idea from it: For as in the *Pythagorean* Composition of the Soul, only the prime

* Πάντες συμφωνῶσι οἱ σοφοί, ἑαυτοὺς οὕτω σεμνύνοντες, ὡς Νῆς ἐστὶ Βασιλεὺς ἡμῖν Οὐρανὸς καὶ Γῆς. *Plat. Philebus*

Ingredient (like *Prometheus's* stolen Fire) is *immediately from Heaven*; so the mixed Materials of *Man's*, and the Soul of the World, are the same, and wrought into the same harmonical Proportions.

Whatever Clouds may have risen in some Mens Minds on the Sight of these Numbers, I should think there was hardly any thing mysterious at the Bottom, unless it was in the Subject itself. In my Opinion, there was nothing further originally design'd, than a Piece of Painting, for the Entertainment of Virtuoso's, this being in the Account of the Antients the peculiar Science of Gentlemen. Αὐτὴ μὲν ἐλδύθερα τῶν ἐπιστημῶν, says *Aristotle*, in the Beginning of his *Metaphysics*; and his old Tutor speaks in the same manner, in the latter End of the *Sophista*, Ἡ ἡρώς Διὸς ἐλάβομεν εἰς τὴν τῶν ἐλδύθερον ἐμπεσόντες ἐπιστήμην.

If,

If, indeed, it be true, that PHILOSOPHY, as she is in herself, is in reality a *Mystery* to the World; it would then be allowed to be no more than just, to give her something of this Appearance. And not only *Pythagoras*, but all the great Antients, may be found to have done her this Justice, varying only her Dress and Behaviour, one after another, as from her Infant State she grew to full Age and Maturity.

As for the literal Numbers of the Soul, they are plainly no other than what were gathered by *Pythagoras* himself, from his Experiments on Sounds: 1 and 2 sounded an 8th: The Harmonical, and Arithmetical Means between them, $\frac{4}{3}$ and $\frac{3}{2}$, sounded the one a 4th, the other a 5th. And, the Proportion of these, was $\frac{2}{3}$, by which they measured out the remaining Intervals between 1 and $\frac{4}{3}$, and between $\frac{3}{2}$ and 2. But neither of these Intervals holding out to even
Mea-

Measure, there was $\frac{256}{243}$ left in each, which they call $\Lambda\epsilon\tilde{\iota}\mu\mu\alpha$.

Plato's Numbers are generated from these original Proportions of *Pythagoras*, 1, $\frac{4}{3}$, $\frac{3}{2}$, 2; by measuring out the $\epsilon\tilde{\iota}\omega\tau\epsilon\lambda\alpha$, thus; 1, $\frac{9}{8}$, $\frac{9}{8} \times \frac{9}{8}$, $\frac{4}{3}$, $\frac{3}{2}$, $\frac{3}{2} \times \frac{9}{8}$, $\frac{3}{2} \times \frac{8}{6} \times \frac{9}{8}$, 2; and continuing this Work till you come to 27.

These are the Numbers of *Timæus*, 384, 432, 486, 512, 576, 648, 729, 768, 864, 972, 1024, 1152, 1296, 1458, 1536, 1728, 1944, 2048, 2187, 2304, 2592, 2916, 3072, 3456, 3888, 4374, 4608, 5184, 5832, 6144, 6561, 6912, 7776, 8748, 9216, 10368.

Though the latter *Platonists* and *Pythagoreans*, or whoever they are, to whom we are obliged for any thing relating to these Mysteries, may not have enter'd thoroughly into the Genius of this Philosophy; yet by the little I have seen of them, I should think they might be

be of good Use towards clearing it up, with the Assistance of *Aristotle*, and *Plato*, to one who was idle enough to set about it. — Something of the Nature of this antiquated manner we have hinted, I think, by *Plato*, in the Beginning of that separate Piece of his, concerning *Good*, the PHILEBUS. And however oddly he may at first Sight seem to talk of *Arithmetic*, in the latter End of that Dialogue, the Language, in a nearer, will not, perhaps, appear so very improper.

For my Part, I don't see how our Moderns, who make that, which is *discrete*, and hath its Parts separated, to be *Multitude*; and then make *Multitude*, in this general Notion of it, to be the Subject of *Arithmetic*; can justly find Fault with it: And as for *Aristotle*, he no-where, that I know of, makes any Exceptions to it. But whatever Regard might be due

C

to

to his Exceptions, in this Case, I should think; notwithstanding those he makes in the Beginning of his *Ethics* to the IDEA OF GOOD in *Plato's Republic*; it was the main Design of his own Works, to clear up this Idea. In this very Treatise itself, to me, I must own, he appears not only to direct the Inquiry after it, but to push it on, as well as he can, without hurting his Readers Eyes by *too strong a Light*, or ruffling the *calm and easy Temper of Philosophy* by the Passions of *Admiration* and *Enthusiasm*.

For what is the natural and just Effect of this Piece on the Mind of the intelligent Reader? His *End*, 'tis plain, in reading, as the Author's in writing, is HAPPINESS. And what does he learn of this kind here? In the latter End he finds, that the HAPPY Man is Σοφός, and HAPPINESS Σοφία; and in the Middle, ὅτι ἡ ΣΟΦΙΑ ἐστὶ καὶ ἐπιεικήμη, καὶ νῦν τῶν τιμιωτάτων τῇ φύσει, καὶ νῦν εἶναι τῶν ἀρχῶν.

That

That this is no true Account of Happiness, will, very likely, be objected, because 'tis such as a Man may spend his whole, or the best Part of his Life, in labouring after, without attaining it, or being qualified for it. And that this was actually the Case of many, will be urged from the Testimony of *Plato* himself. Ἀρ', ὡ Θεαίτητε, νῦν τηδε τῇ ἡμέρᾳ εἰλήφασκεν, ὁ πάλας καὶ πολλοὶ τῶν σοφῶν ζητῶντες πρὶν εὑρεῖν κατέγγρασαν. But to this it may be sufficient to say, that tho' this may not be *the only*, it may be the *chief Happiness*, that human Nature, in its best Situation, is capable of; and that *Aristotle* thought so. In his *Treatise on the Soul*, he speaks of *Nēs* in the same manner as it is understood in the *Timæus*; and in his *Metaphysics* he speaks of it as *God*. But his *Analytics*, if we will hearken to him, must first have a Place in our Minds, before we proceed to that *last Speculation* concerning *PRINCIPLES*: And,

C 2
per .

perhaps, when one compares him with *Plato*, it may be a Question (since he takes the Honour of *Analytics* to himself), Whether it was not for want of such a *complete Theory of Science in general*, as this is supposed to be, that *Plato*, as the Foundation of *his* GENERAL ANALYSIS, WHICH LEADS UP TO THAT WHICH IS FIRST, prescribes the *Mathematical Sciences*, particularly in his Republic.—If by the late Translation of this Piece, perused and recommended by Mr. *Fontenelle*, one might be allowed to judge of the *French* Taste; one should be apt to conclude, that with regard to these superfine Speculations, they remain'd on the same Foot as they were in the last Age. If you please to peruse only the concluding Part of the 6th Book, I fancy you may be inclined to think so too. For my part, I must own, from the little Acquaintance I have with these Gentlemen, my best

French

French for BEAUTY is their *Je ne sçai quoi*; and I doubt TRUTH and SCIENCE must with them stand pretty much on the same Bottom in the Judgment of *Plato*, who asks *, *How is it possible where that which is first is unknown, and where that which is last, together with that which is intermediate, is made up of what is unknown; that such an Assent of the Mind should be Science?* — That the *Republic* was designed to go along with the *Timæus*, is evident, without looking further than the Introduction of the latter. And why does the *Book of Laws* end in that Perplexity but to make way for the *Epinomis*, and to introduce again the same *Timæus*? The *Sophista*, *Theætetus*, and other Dialogues writ in this View, discover themselves what was their End, as well as a Multitude of particular Passages up and down the

* *Reip. L. VII. sub fin.*

Writings of *Aristotle* and *Plato* both, if you can think it worth your while to turn them a little over. I am, &c.



LETTER III.

ACCORDING to the Antients, there were *two Sorts* of ARITHMETIC; one, *peculiar to Philosophers*; the other, which is *vulgarly* so call'd, in which the Units or Monads were all *equal, without any Difference*: whereas in the other they were *unequal and different*. 'Tis the Principles of the former which I have now under Consideration; the same I suppose with *Aristotle's Syllogistic Principles*, the Knowledge of which
he

he calls Νῆς, and which *Plato* comprehends under the Word Σοφία.

Take any two Things whatever: Let them be *never so different*, yet each still is. BEING or ESSENCE necessarily cleaves to each; nor can this Idea of *Being*, as common to both, be perceived without an *antecedent Idea* or *Perception* of IDENTITY: And as for the *Idea* of DIVERSITY, that, 'tis evident, is likewise necessarily supposed; so that from the Notion of *Two* is necessarily imply'd these *Three* Ideas, BEING or ESSENCE, IDENTITY, and DIVERSITY; and a fourth made up of these: For each of these Things called Two, is, and is the SAME, and DIFFERENT from the other; that is to say, BEING, IDENTITY, and DIVERSITY, are UNITED, and meet together in each; for otherwise they are not at all, or are not Two.

Now, as this TETRACTYS gives me the Idea of *Two*, so, repeated, it gives me that of *Three*, and, repeated again, that of *Four*, and so on. For, if the Repetition stop any-where, or be limited, it always presents us with a *certain* Number, that is to say, *so many*. Whereas, if it be continued *indefinitely*, it then presents us with MANY; not so MANY. So that, according to this, MANY may be defin'd to be *an indefinite Repetition of the Ideas of Being, Identity, and Diversity, joined in One*.

This the Antients seem enigmatically to have hinted in their dark Sayings about the Four Monads 1, 2, 3, 4. As these, together, made Ten; so, repeated again, they made another, and again another, and so on. Thus were all Numbers and all Things produced from THIS SOURCE.

Now on the Being of MANY seems to depend that of KNOWLEDGE.— For, if there be not *many*, then there

is not THE SAME IN MANY ; and, if there be not *the same in many*, then there is nothing GENERAL OR UNIVERSAL ; and then no *Reasoning*, *Syllogism*, or *Demonstration*, and so NO KNOWLEDGE.

As, in the Account of the Antients, there were *Four Original Notes*, from whence sprang all *Harmony*, so they called these Notes, or the Numbers that measured them, TETRACTYS. And as *Compositions in Music* bore a Resemblance to *Systems of Knowledge* in the Understanding, to find the PRINCIPLES OF MUSIC, and to find those of KNOWLEDGE, were Problems of a like Nature.

The ἐν κρᾶμα of the old *Timæus* I take to be our BEING, *Essence*, or εἶσα, as it is common both to the *Invariable Objects of Understanding*, and the *Variable ones of Sense* ; and his δύο δυνάμεις I take to be our ἕτερον and ταυτόν, as *these* are likewise common to the same Things, and in the same

same Manner, as *Being* or οὐσία is ; and for our Fourth complex Idea, that, I suppose, is produced by his Second Mixture, which, by the way, we may observe to be antecedent to the Being or Formation of the Soul.

With regard to the *Syllogistic Principles*, *Aristotle* lays down this, as the Principle of all Axioms whatever, on which the particular Sciences proceed, as evidently true in themselves, without Proof ; viz. *It is impossible to affirm and to deny one Thing of another at the same time, and in the same respect.*

Now, as to *deny* one Thing of another, is to say, it is *different* from that other ; so, on the contrary, to *affirm* one Thing of another, is to say, it is the *same* with that other : And thus his Principle comes to this. — It is impossible to say, that one Thing is different from another, and that it is the same with that other, at the same time, and in the same respect. And the Reason is, because
then

then the *Same* and *Different* would be the SAME ; that is to say, the Being of IDENTITY and DIVERSITY is the Reason.

There is no Subject, in my Opinion, more capable of enlarging the Understanding, and exalting the Mind, than this, and what belongs to it.

There is one Remark I have often made on *Xenophon*, with regard to the Subject of *Knowledge*, by which Men differ from Brutes. — According to *Socrates* in *Xenophon*, the ἀνθρώπος is a *Brute*, in giving himself up to the Influence of *present*, that is to say, *particular* Objects : And to the contrary Character alone he allows διαλέγεσθαι κατὰ γένος ; and the very Definition of γένος is ὁ πλείοσιν ὑπάρχαι πέφυκε, that is to say, in plain *English*, *the same in many*.

So that from hence a BRUTE may be defined to be a *Creature whose Motions are determined by* PARTICULAR

TICULAR *Objects*; and a MAN to be a *Creature*, whose *Motions* are determined by GENERAL *Objects*. For what *Socrates* would have inferred is this, that, so far as we are determined by *particular Objects*, so far we are *Brutes*; and so far as we are determined by *general Objects*, so far we are *Men*. Thus, for Example, the *Persians*, who carried with them always One *General Idea of Right Behaviour at Table in general*, and were influenced by this general Object, and not by the Particulars which accompanied each Day's Table, were, in *Socrates's Account*, MEN. The *Medes*, who were *acquainted with no such general Object*, but were carried away with the *particular Circumstances* that came in their Way every time they went to Meat, these, by the same Account, were so far BRUTES.

L E T-



LETTER IV.

WHAT is it in general, *to find out Truth*; and *How do we come by it*? To find out Truth is, *to find out general Ideas*. And how are these got into the Mind? By means of *Sense*; Two Ways. The one easily, and as it were of a sudden; the other with more Difficulty, and Expence of Time. My Sense presents me with a Triangle. On this Occasion I have One in my Mind, and not only One, but *many*, as many as I please; and this no longer by virtue of *Sense*, but by virtue of having a *Mind*. And all this Ideal Order of Being, in which I find one and the same Form in the
 Many,

Many, is what we call a Triangle. This then is *One General Idea*, and *One Truth*, when I know what it is in itself, and how it differs from all other Forms; that is to say, when I perceive it a plane Figure, comprehended within Three strait Lines. When to this General Idea I join the Idea of the Quantity of its Angles as Two Right, then I have another General Idea of a more complex Kind, or another Truth; *viz. the Idea of a Triangle's having all its Angles equal to Two Right Angles*. If this complex Idea does not come so easily into the Mind as the former, the only Reason is, the Difficulty of Attention to the intermediate Ideas of the Demonstration. But suppose the intermediate Ideas presented to the Mind, and the Mind as easily to attend to them, as to an Object of Sense; in this View the complex Idea, or new Truth, instantly and necessarily results.

But

But there are *another* Kind of General Ideas or Truths, which, with the greatest Attention, are not capable of being thus instantly and easily acquired ; but call for many Applications of Mind at different times. Such are all those *General Ideas or Truths* comprehended under *Aristotle's* *Ἐμπειρία*. For Example ; My Sense presents me with a particular Man, *Callias* or myself, or with *Callias* or myself, drinking Water ; and hence, without any more Application of Mind to *sensible* Objects, I have as easily the General Idea of *a Man*, or of *a Man drinking Water*, as I had before of a Triangle. In like manner, from the Sense or Perception of myself or *Callias* sweating, I have as easily the General Idea of *a Man's Sweating*. But then, by no working of the Mind within itself can I discover this general or complex Truth, *that every Man drinking Water sweats upon it* ; or, in other Words, find

4 Sweating

Sweating joined with *every Man drinking Water*, as I found the *Quantity of Two Right Angles* joined with *the Angles of a Triangle*. This requires Time, and many Applications of the Mind to particular Men (or, which is the same, to one Man, at many particular Times, if that will do) drinking Water. Now when many times I have found *Sweating* joined with that other Idea, then I conclude, that *Every Man drinking Water sweats upon it*; or thus discover the general Idea of a Man drinking Water, and sweating upon it, or these several Ideas *joined together*. This last Expression puts me in mind, by the way, to observe that noble Distinction of the Antients, as to the different Objects of Reason. When Ideas are *so* joined together, that the *Being of their Union* depends on *the Being of the Ideas united*, this is τὸ ἐξ ἀνάγκης, or ἐπισηλόν. But when Ideas may exist *separately without*
such

such Union, this is δόξατον or ἐνδεχόμενον ἄλλως εἶναι. A Man drinking Water *may be without Sweating* joined with it. But a Triangle cannot *be, without having Angles* which are Two Right. Now this puts me in mind of another Thing, which I cannot help mentioning, to let you see the Manner of *Aristotle*. His τὸ δὲ ἐν ποιεῖν, τοῦτο ὁ νῦν ἕκαστον, is the *φιλία* of *Empedocles*, by which he means *the Energy* (I suppose) of *the UNIVERSAL MIND* in *particular Intelligent Beings*, as well as in *the Sensible Universe*. I have separately in my Mind, before I understand the above-mentioned Proposition of *Euclid*, the νόημα, or Idea of a Triangle. I have likewise that other νόημα of Two Right Angles. 'Tis THIS ENERGY (as I take it) he means, which unites *these* in my Mind, at the Instant I understand that Proposition. This, I suppose, is all the MAKING. This complex Idea was never *made*. Its

D Being

Being is *prior* to my Perception of it. But, to return; Take another Instance of the above-mentioned: My Sense presents me with a particular Man with Pain in his Head, and an high Pulse. Hence, I have a general Idea of a Man with a Pain in his Head, and an high Pulse, as before. But it requires Time to find out a Man with such Pain in his Head, and an high Pulse, joined with a Fever. And when this is found, it likewise requires Time to find these Ideas joined; a Man with Pain in his Head, and an high Pulse, and a Fever, losing his Fever by sweating. But, when this is done, then I syllogize in the following Manner:

Every Man, who has a Fever, loses
his Fever by Sweating.

Every Man, that drinks Water,
sweats.

Every Man, that drinks Water, loses
his Fever.

Every

Every Man with a Pain in his Head,
and an high Pulse, has a Fever.

Callias has a Pain in his Head, and
an high Pulse.

Callias has a Fever.

Every Man drinking Water loses his
Fever.

Callias drinks Water.

Callias therefore will lose his Fever.

Callias is sick : Suppose a Physi-
cian is sent for; then the Course of
his Thoughts is this : *Callias* has a
Pain in his Head, and an high Pulse,
a Fever, Sweating, drinking Water.
The End is, curing *Callias* ; but the
ἐσχάτον ἐν τῇ ἀναλύσει is Water, which is
πρῶτον ἐν τῇ γενέσει, or in the Genera-
tion of the Cure. Drinking Water,
Sweating, Abatement of the Fever,
Cessation of the high Pulse, and Pain
in the Head, *Callias* cured.



LETTER V.

THE Speculation of the GREATEST and NOBLEST OBJECT in Nature, one would think, might innocently be indulged without measure : But it is not so : The principal Thing is DISCRETION, which gives to every thing we do its proper Place, Time, and Measure : And, when the Inclination runs high that other Way, it breeds what Mr. *Ashley* calls a TYRANNY in the Mind, of as ill Consequence, perhaps, as any other inferior Appetite. To be bid to acquire the deepest and most abstract Knowledge of Things, and to contemplate the GREATEST OF ALL OBJECTS, IN WHICH THE BEAUTY OF
THE

THE UNIVERSE IS SUMMED UP ; and to be bid to do this, with an easy and free Mind, with a sort of Indifference, without those Features of Eagerness and Discontent, which are so visible on the Faces of those who study inferior Beauties ; this may seem a hard Task, and impossible.

But however, unless we can submit to it, we shall make ourselves *miserable* while we are seeking *Happiness* ; and, besides that, we hinder ourselves from attaining that *Knowledge*, which we so earnestly pursue. — Tho' I have been sensible of this for some Years, yet at this present I feel the Effects of it. At length I am, or I am much mistaken, fallen into a right Taste of *Aristotle*, who has thrown me into such a Flame for a good while together, that has almost burnt up my Discretion. He now appears to be all that can be expected from the GREATEST GENIUS, that lived in the *politest* Age the

D 3 World

World ever saw. He studied long under *Plato*, and that too at a time when he was capable of learning the most, and when the greatest Part of Scholars think they know enough already : And, had *Plato* been in his Place, he certainly had written as he has done. For, what has Philosophy to do with the Riddles of *Pythagoras*, or the poetic Dress of *Plato* ? Her natural Dress is certainly that of *plain, simple Reason*, which *Aristotle* has given her ; who alone could be expected to give it her ; his Predecessors not having the Advantages which he had ; nor living in an Age in which such a Dress could appear so handsome.

They had enough to do to practise and teach it, and write it in such a manner as they were best acquainted with, and was most suitable to the Genius of the Time they lived in ; confining themselves to what was more immediately useful, they

they had not Leisure to lay the Whole out in a regular Syſtem of Science ; ſo much Speculation in them would have been inconfiſtent with the Inter-eſt of Virtue and Mankind. But in a Succeſſor, ſuch as *Ariſtotle*, it ſeems to me to be no more than what was naturally to be expected.

But, after all, I am far from pretending to a finiſhed Taſte of *Ariſtotle*. It is chiefly with regard to his Method of leading his Readers into the Notions of *Pythagoras* and *Plato*, that I ſo much admire him. Notwithſtanding what I have now or formerly ſeemingly ſaid againſt theſe Speculations ; I am very well ſatisfied they ought gradually to be carried on together with the Buſineſs of Diſcretion. And, as to this very Thing, *Ariſtotle*, in my Opinion, will prove a better Maſter than any Author I ever ſaw.



LETTER VI.

THE Sorts of Things, *are Things that now are, have been, and shall be, and Things that strictly ARE* *. The Are's, in the former Sense, are Things that lie between the Have-been's and Shall-be's. The *Have-been's* are Things that are *past*; the *Shall-be's* are Things that *are to come*. The Things

* There is another Sort of Being which is not discovered in a direct View by Sense, or the Understanding, but in the way of Analogy by the Understanding. This is the Foundation of natural Productions. There is something which admits of several sensible Forms; and this is to Form, or whatever is or can be justly said of any sensible Thing expressing its Nature, as a Piece of Marble is to a Statue.

that

that ARE, in the latter Sense, are Things that have not been, nor shall be, nor stand in the midst of such as were before them, or shall be after them.

The Things that have been, and shall be, have respect, as we said before, to Present, Past, and Future. These, likewise, that *now* are, have moreover Place; that, for Instance, which is here; that which is to the East; that which is to the West.

The ARE's, strictly so called, have been perceived, and shall be perceived, tho' they have not *been*, nor *shall be*. And tho' the Perceptions were in *Time*, yet they were not in *Place*, meaning, by Place, Room for Body. These Perceptions, and *Things perceived*, may be, I suppose, where there is no room for Body, or, if you please, a *Plenum* of Body.

The Question is, Whether these ARE's, strictly so called, are *Copies of other Things that are standing in Nature*

Nature without Mind, or whether they are *derived into the Mind from particular Things without*, or *taken off from them by the Mind*, being no more than what are called *abstract Ideas*, Things that are but *Shadows*, and have no real Subsistence? — Be it so; and let us go further. Whence comes this System of *sensible Things*? — 'Tis made up of original Parts of *Matter*; 'tis a Building raised out of these. By whom, or what? By Mind, or Intelligence. — What is this Mind? — 'Tis I know not what; 'Tis nothing like the Human Mind; we have no Notion of it, only this, It does not understand Things by *Images*, and *abstract Ideas*, but by *being every-where present to Things*. Thus we are in a World where there is no Light, but rather *Darkness visible*.

The Things that now are, have been, and shall be, are all variable. In Demonstration they have no Place,
much

much less in that higher Speculation concerning God. God is, has not been, nor shall be, tho' *His Being* be accompanied with Things that *have been*, and Things that *shall be*, these varying, HE HIMSELF INVARIABLE, AND FOR EVER THE SAME.

Something is; therefore something always has been; *viz.* there must have been ever a *Cause* preceding something. This seems to relate to successive temporary Beings. That which ever *has been*, and *shall be*, is a Series of Things *dependent* upon one another. There must therefore be some Being *independent*, upon which this Series depends; and this *independent* Being must either stand at the Head of the Series (which, if supposed to have no Head, is a Thing impossible), or else it must be a Being which holds the Series together thro' every Link.—This Speculation properly belongs to Physics; and

and therefore *Aristotle* has placed it in his *Physics*.

The Objects of Knowledge are necessary and immutable ; they cannot therefore be *otherwise* than they *are*. As to Things that may be *otherwise* than they *are*, we are at a loss to know whether they are, or are not, when they are out of View.

I am certain, that a Man who looks upon *outward* Things as indifferent, and places his HAPPINESS *within* himself, is not disturbed about *outward* Things, as those are, who look upon them as *good*. Of this I am certain ; I am certain that this is, even when I have it not in View : But I am not certain, that a Man, who has taken Tar-water into his Stomach, is easy, unless he tells me so. The ἡρεμεῖν, which accompanies the τὰ καθόλου, is consonant with μὴ ἐνδέχεσθαι ἄλλως εἶχειν ; as κινεῖσθαι is the same as ἄλλως εἶχειν.

The

The Composition of the Soul, in the *Timæus*, is BEING VARIABLE AND INVARIABLE JOINED TOGETHER. BEING VARIABLE AND INVARIABLE, IDENTITY AND DIVERSITY LIKEWISE JOINED TOGETHER, make the Ideas which are the Principles of KNOWLEDGE and OPINION. And therefore *Plato*, in his Republic, cuts this System into Two Parts, the one Variable, the other Invariable; the one for *Science*, the other for *Opinion*.

The Objects of Science must be invariable and fixed: Upon this its Certainty depends. In proportion as any Object is variable, is our Judgment about it uncertain.

Should we suppose, that Rhubarb, every time it was used, altered its Properties, Physic could with no Certainty in any Case affirm, that it was an Astringent; should it vary many times, there would be more Certainty; few times, more still; and no time, most of all.

But,

But, after all, where do these Objects of Science reside, *when they are out of View?*—They reside *every-where* in that MIND, *which is present every-where*; and are every-where exhibited in the same manner to all Rational Beings; and are admitted for the greatest Evidence and Certainty by the Men of Science, who at the same time appear but to *dream*, to those who have Eyes to look up to the *real* Evidence, and see it as it is.

This Enthusiasm seems to be a necessary Passion, in order to make *Virtue* complete. Nothing exalts the Mind more above *sensible* Things: Nothing so proper to call off Admiration from Men and Things.

“ ’Tis not Things, but the Opinions of them, that give Men Disturbance.”—This gave *Socrates* that easy serene Countenance, which was always observed the same in him, together with that peculiar Confidence

dence he had in himself, from his own superior Sense of Things, and that Strength of Mind which enabled him to preserve it; both which must arise, and be preserved, by repeated Experience, and daily confirmed Habit. By his own superior Sense of Things, I mean his Knowledge of the GREAT GENIUS *present* every-where, his Knowledge of KNOWLEDGE and ART.—What poor blind Creatures must Mankind appear to Him! They could not distinguish Fancy, or Imagination, from Reason, and paid more Regard to Custom and Fashion, than to Nature. He knew, in the most perfect Manner, that there was nothing belonging to Reason, but what took its Evidence from Experience, in the way of Art, or from self-evident Principles, in the way of Science. As he was likewise acquainted with the Sentiments natural to Men, he could by this means lay hold upon them by their own Prin-

Principles, Sentiments, Fancies, or Imaginations, and so lead them into a visible Absurdity. In short, he knew when to instruct, and when to embarrass, and when to pull down Pride and Self-conceit.

General Ideas seem to be very well compared to a Standard. For it is by these we measure either other *general* Ideas, or *particular* ones, and so discover Truth : And thus one Truth is discovered by another.

BUT GENERAL IDEAS THEMSELVES are measured by that which is MOST GENERAL, AND COMPREHENDS THEM ALL. 'Tis on this their Being depends. As the Application of one *general* Idea produces a new Truth; so does the Application of MIND IN GENERAL producethose general Ideas: And as all Truth depends on such as are known before, *so must all that are known before, on that which precedes all.* So that that Truth, which is the Foundation of all new Truth, may

may be called TRUTH ITSELF. Its Being certainly must be at least as real, as those general and eternal Truths derived from it. Truth, then, MIND, or Truth itself, is the STANDARD of all particular Truths. That which applies general Truth is REASON; and to apply this Standard, or general Truth, is to syllogize.

It was wrong to say, that Truth, strictly speaking, was produced: Then it was not before. 'Tis only discovered to the Mind; which did not perceive it before. If, when discovered, it was produced, then, before the Discovery, it was not, which is impossible to conceive: For then it is not Truth. TRUTH is that, which 'tis impossible to be otherwise than it is, and has nothing to do with Time. For Instance; I now know, that the Angle in a Semicircle is a Right one. If this be now produced, then before, it was not. But it is impossible, that

E the

the Angle in the Semicircle should ever be otherwise than a Right one.

All new Truth is discovered by means of some general Truth *known before*. By means of any Truth which is not general, no new Truth can be discovered. For Example; if I know only that *one particular* Triangle has Angles equal to Two Right, I cannot infer, that another has. Nor, if *many* have this Property, can I infer, that this which I have under Consideration, is *one* of that *many*. Nor, if I know, that an infinite Number of Triangles has this Property, can I know, that *this*, which I have under Consideration, has it too. But if I know, that EVERY Triangle has this Property, then I know, that *this particular one*, since it must be, of Necessity, *One* of the EVERY, must have it too.

As the Truths of all Theorems and Propositions whatever are resolved into this Maxim. *It is impossible for the same*

same Thing to be, and not to be, it follows, that, if there be not in Nature something which is properly the SAME, and INVARIABLE, there is no such Thing as TRUTH. It is this ETERNAL and INVARIABLE BEING, which is the Foundation of all Truths whatever, and is called by the Antients **NOMOS**.

If therefore any thing is true, this is true, that **THERE IS AN ETERNAL INVARIABLE MIND**. And if there be that **MIND**, then there is **TRUTH**. So that the Assurance we have of God's Existence comes from God himself.



LETTER VII.

IF *Aristotle* argues against *Plato* and the *Pythagoreans*, he argues in the same manner against himself. If we compare only what he says of the Definition of the Soul, in the 3d Chap. of the 6th Book of his *Topics*, with what he says of it, or *Nũs*, in the last Chap. of the 4th Book of his *Physics*, *Nũs πέφυκεν ἀριθμεῖν*; one cannot but conclude it to be his real Opinion, that the SOUL is a *Being which is Number moving itself*; at least, that he thought this the best Definition that could be given. Turn to his First Book of the Soul, and there you see him arguing against it: And his Comparison of the *Soul* or *Mind*

Mind with Time, what is it, but a sort of Comment on that Passage, which *Plato* has subjoined to his Composition of the Soul? *TIME*, says *Aristotle*, is the *Number of Motions*: The *SOUL*, or *MIND* (he says), is likewise *Number*. But Number of what? Of *Things standing* or *permanent*.—Thus you see all that moves is the Image of that which *stands*. There is an *Energy* joined with the *standing Numbers*, which actuates and maintains the *moving ones*. What I just now mentioned, seems to be represented, in *Plato's Timæus*, by the fixed Stars, and moving Planets; and somewhat like it, is, I think, hinted in the old *Timæus*.—But of any such enigmatical Meaning *Aristotle* takes no Notice. In what he says against the old *Timæus*, in his First Book of the Soul, he apparently falls foul with him, as if he designed to give us not an *Image* or *Likeness*, but the *Thing itself*.

In this *Plato* and *Aristotle* are well agreed, *Plato*, in his Tenth Book of *Laws*, speaks of this Way of Representation by a Circle, and circular Motion, as only an Image ; and has an Expression something like this: *To think to have an Idea of God this Way, is using Midnight, instead of Noon-day, to discern Things with the Eyes.* And *Timæus* himself, just after he has done with the Division of the Soul, reminds us, *that 'tis Mind only sees God, as the Eyes see the visible and sensible World.*

Perhaps 'tis a mistaken Notion of this Passage of *Timæus*, or others like it of the Antients, that has made the Moderns go about to prove immediately a Deity by his Idea.

The Meaning of *Timæus* I take to be this—to spur us up to the Inquiry what Mind is, and to hint, that when we have the Knowledge of this, we have at the same time a Knowledge of the
DEITY,

DEITY, which is the same. But to return.

Aristotle tells us, Book 1st, Chap. 3. of the Soul, that *Timæus* means by Soul that which is called Νῦς that Νῦς is a continued undivided Thing, not as *Magnitude*, but as *Number*; and that, if it be a Thing diffused throughout the Universe, it does not understand or perceive Things by its Parts; but, if we speak of Parts, by all its Parts at once, it understands all Things every-where. Something of this seems to me to be suggested.—Again, what is the πᾶς λόγος of *Aristotle*, but the λόγοι οἷδε πάντες of *Timæus*, which make the one Idea of being, same, and different joined together in *Plato's* Mixture.

I believe I might observe more of this, and other Particulars, which he here seems to urge by way of Opposition against *Timæus*. But I shall only take notice of the last Words of this Chapter, which I think are extremely beautiful.—*We are not*, he

says, to imagine the Soul or Mind joined to Body, as if we were to join Masonry with a Violin, or other Instrument of Music made by another Artist, and make the one to be animated by the other.

How then are we to suppose Body and Mind, or the variable and invariable Parts of Nature, joined?— Now I have mentioned this, take a Translation of a Passage in the Close of the 8th Chap. of his 2d Book of Physics.— 'Tis absurd to imagine there are no final Causes, because we do not see the efficient Cause under Deliberation. But neither does Art deliberate; for, if Ship-Carpentry were in the Timber, it would do just as Nature does: So that if there is in Art an End proposed, there is also in Nature. But this is most apparent, when any one heals himself; for to such a Man Nature is very like.

The Reason why he says Art does not deliberate with itself, I take to be

be this. He is only *δυνάμει*, an Artist who deliberates or consults with himself. He is not such *ἐντελεχεία*, that is to say, he is not a perfect Artist. For to *deliberate*, or *consult*, implies *Inquiry after Knowledge*; and that implies the *Want* of it.

The concluding Part of that Chapter, where he argues against the Definition of the Soul as consisting of Motion and Number, may be sufficient to discover him in that Argument. Had he thought the Nature of N^{rs} not explained as well as could be, by that Definition, he would most certainly have given his Reasons for it; and his having not done it, is a plain Indication of his Opinion.— You can't *explain*, says he, *the Passions and Operations, the Cogitations, Senses, Pleasures, and Pains of the Soul, by that Definition.*—But this is no Argument why it may not be the Definition of the *intelligent Part* of the Soul.

LET-



LETTER VIII.

AS to *Aristotle's* Character as an Author, you will think it strange when I tell you, that he is like *Xenophon*. For, at the Bottom, 'tis the same Manner which they have both taken. The one instructs by a *Story*, and what seems to be casually said in telling ; the other by *plain Reasoning* ; and, to prepare you to learn of them, they both alike make you sensible of your own *Ignorance*, and Want of Instruction, and at the same time inspire a Desire of Improvement. *Xenophon* has done this by his Representation of *Virtue* in the Character of *Socrates*, and by
the

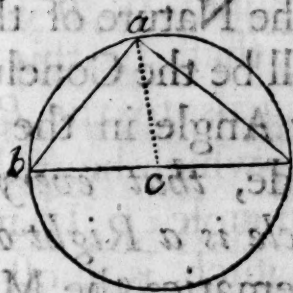
the Dialogue of *Socrates* and *Euthydemus*. *Aristotle* has done the same with regard to *Knowledge*. What he says of it in the Beginning of his *Metaphysics*, not to mention other Places, I dare say, never fails to animate his Readers to the Pursuit. And his *Metaphysics*, instead of informing the Reader in what he expects to have immediately transfused into him, never fail to inform him of what is more valuable to him to know (since the other is impossible), *his own Weakness*. The Method of Instruction *Aristotle* has taken, is, in reality, the Method of Nature. He leads us from that which is *plainest*, and *most evident to us*, to that which is *brightest*, and *most evident in itself*.—As he leads us through all the Scenes of Nature, before he brings us to *the Source of all*; so he gives us a plain summary View of Reason, before he brings us to the *Principles of Reason*. And this was the Use he intended

tended to make of his Doctrine of Syllogism; that, by this Method, he might bring us to the *Principles* of Knowledge, which he truly calls *syllogistic* Principles. That he began with that which is most evident to the common Reason of Mankind, is plain from this, That all Mankind have been convinced of the Truth of what he says about Syllogism, though none have hit upon the *secret Charm* which runs through all, and so powerfully wrought upon them, and which indeed runs thro' all Things.

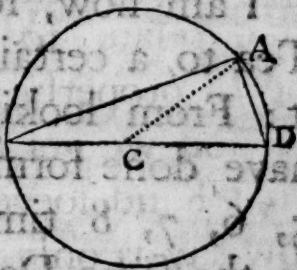
But to let you see, that *Aristotle* has taken the right Method, I must put you in mind of those Passages that relate to *Induction*. For, in short, properly speaking, 'tis by *Induction* we get all our Knowledge, of what Kind soever; and even what I now say is only to be understood by *Induction*. I shall give you one or Two Instances, and leave you to make the *Induction* by more.

behest

How



How do I come to know, *that every Angle in a Semicircle is a Right one*? When I first inquire about it, I have only one Angle $b a d$, which I have here drawn (and another, if you please, in my Mind, correspondent to it). By drawing $a c$, the Radius, I make the Isosceles Triangles, and only conclude, that this particular Angle $b a d$ is a Right one. I then draw another in my Mind, or on Paper, $B A D$; I find my Isosceles Triangles still accompanying my Right Angle in the Semicircle, and I find this also to be a Right Angle; and



and from the Nature of the Circle, I find this will be the Conclusion about every other Angle in the Semicircle, and conclude, *that every Angle in the Semicircle is a Right one.*

In Mathematics the Mind is very quick in making this Induction ; but the Antients were quick enough to spy her out. But, if the Induction be made, and the *no ratios* understood in these Subjects in a few Instances, it requires more Time in other Subjects which are of much greater Importance to us. But I shall chuse to give you an Instance in one which is seemingly of the lowest Class.

I am now, for Instance, drinking Tea to a certain Degree ; I observe it : From looking back on what I have done formerly, I can recollect 5, 6, 7, 8 times, when I drank it to the same Degree ; and every one of these times I find my Nerves were affected. Hence I conclude (or form a general Proposition), that every
time

time I drink Tea to such a Degree, I hurt my Nerves. I lodge this in my Memory, which I have acquired by many Inspections. To-morrow I watch myself, and find myself going to drink Tea again to the same Degree as before: Then I reason with myself thus: Every time I drink Tea to such a Degree, I hurt my Nerves.

I am now going to drink it to such a Degree.

I am now going to hurt my Nerves.

Thus *οἶδα ὅτι πάλιν*, and by the same Standard I know the State of another Man's Nerves, whom I observe to drink Tea to the same Degree.

After this manner you will see the Reason which *Aristotle* gives, why a Boy may understand *Mathematics*, but not *Morality*. That Passage of *Aristotle* to me is extremely beautiful, in his manner of Writing, as well as of the highest Importance.

But to apply my Doctrine to the Business of Syllogism: I said just now,

now, he gave us a summary View of Reason, in order to lead us to the *Principles* of Reason. But, to take this summary View, it must be observed how all Forms of Reasoning are included in his First Scheme, that is, to see how the other Schemes are reduced to that; and see this not only in the Instances given by him, or the Schoolmen, but in Instances taken from other Sciences, especially Geometry. And when we see by Induction, that all is reduced to his First Scheme, we are to see, *what is that which is the same in each, and gives Light to every thing.* And this is done by Induction. And if we do not make the Induction the Way he leads us, we must do it some other Way with more Difficulty, or else never pretend to know the Principles of Reason or Knowledge.

L E T



LETTER IX.

THE HARMONY, UNION, AND
CORRESPONDENCE OF NATURE,
CONSIDERED AS ANIMATE AND IN-
TELLIGENT, that is to say, confi-
dered as ACTIVE, SENTIENT, AND
INTELLIGENT.

If there is a *Harmony* and *Corre-
spondence* of *Nature*, considered as
PASSIVE, there must be a proportioned
Correspondence and *Harmony* in Na-
ture, considered as ACTIVE ; that is,
considered as the CAUSE of that *other*
Harmony and *Correspondence*.

For Instance, she acts harmoni-
ously, and correspondently with her-
self, in imparting KNOWLEDGE from
F the

the same GENERAL PRINCIPLES, whether in the way of Science or Opinion, and in the same regular Manner to *Men*, and to *all other Intelligences* that any-where exist; not leaving them in their Motions to CHANCE, but giving them A LAW, which they cannot forsake, a *determining Principle of Action*, in their UNDERSTANDINGS, that is, in THEMSELVES.

And, in general, she acts everywhere like herself, as she imparts BEING, FORM, and ORDER, to all Things alike, casting all, as it were, in the same Mould * Εἶδος καὶ γένος ἀπολυπᾶται πάντα ἡ φύσις.

And if we lay aside this *relative* View of Nature, and consider her as she is *in herself*, not as ACTING, but as SPECULATING, I mean, as having SENSE and INTELLIGENCE; in this View, she likewise appears to *harmonize and correspond with herself*; from whatever Point of the UNI-

VERSE she directs her Eye, having there the same *full* and *easy* Prospect of the *Universe*, which she has any-where else, together with the same INTELLECTUAL OBJECTS there in her Mind, some of them copied in what she sees, some not, and only within herself.

How perfect is this Harmony and Correspondence of Nature! There is no Comparison between it and the Correspondences of *Men*, or of the *highest Intelligences* that can be supposed; because, however numerous and perfect they may be in themselves, and in their *Harmony, Friendship, and Correspondence with one another*, they are still MANY, and have many *separate Consciousnesses*, one to each of them, not one *common to them all*; and because their Intercourse is not *instantaneous*, but *in time*, and by *Succession*; and by some Medium or other, not by IMMEDIATE CONSCIOUSNESS AND INTUITION.

How *intimate* is this UNION of NATURE ! Not of many Things, one here, and another there ; but of ONE THING every-where the SAME. How different *this Union* from that of other Things ! IMMUTABLE, ETERNAL, SIMPLE, PURE, UNMIXT ! *How wide*, and *extensive* ! COMPREHENDING ALL THINGS ; and, though COMMENSURATE to the *Understanding*, yet exceeding the Bounds of Imagination, or any thing which has something beyond it !

L E T-



LETTER X.

TO know what MIND, TRUTH, and REASON are, and that the DIVINE MIND is ever *present with you, guiding you by Reason in whatever you do or think rationally,* must, above all Things, raise one above the World. Here is that Object of Enthusiasm, which is the justest in the World. No Wonder the Antients laid so much Stress upon this Principle, and took such Care to hinder it from being profaned, and to make it in the best manner understood at the same time.—Without

this, *Philosophy* is a dull Thing, and inefficacious.—Is it possible to imagine the antient *Stoics* were ignorant in this Point, whatever the Moderns were?—Even *Pericles* had this Knowledge, and seems to have learnt it from *Anaxagoras*, as I suppose *Socrates* himself did. I conclude this from the latter End of the *Phædrus*, where *Socrates* ascribes the Force and Sublimity of *Pericles's* Genius to this Knowledge. 'Tis just before he comes to explain the Art of Speaking by the Art of Physic.—Perhaps the Antients thought it not safe to publish this Doctrine of *Divine Inspiration* to the World. 'Tis remarkable that *Socrates's* Pretensions to it are only justified by *Xenophon*, on the Footing of vulgar Faith. And may not what *Socrates* privately taught on this Subject have been blab'd abroad? But I must have done with this Subject at present, of which the least one can

can say of it is, that 'tis of ALL others the most engaging.



LETTER XI.

O*Utward Things* proceed in one immutable Order, and so do *inward Things* too. Mr. *Locke* says, we do not think always. But he allows, that we think always when we are awake. And so far, no doubt, our Power is limited. We cannot help thinking; and the Laws by which our Thoughts proceed, and by which we are turned over from one Thought to another, are *general*. We must give our Assent to *Truth*, and deny it to *Falshood*. We must pursue Good, and refrain from Evil.

Things, or the Appearances of them, always determine us.

All rational Motions, whether they terminate in the *Mind*, or on *outward Things*, I mean all rational Speculation, and Practice, are from the immediate CAUSE OF REASON. He that sees this fully, is not only satisfied with the Evidence of his rational Proceedings, but has the Pleasure of knowing he has the *best Authority* in the World, on his Side.

My Mind is not now in Tune; the Cause is, a Cold; that Cold is from the external Order of Things; and that external Order of Things is from GOD: And in this View GOD is a remote Cause.

Dr. Clarke says, MORALITY consists in a Power of doing otherwise than you do at the time of doing. I think the contrary. We have no Power to do otherwise than we do at the time of doing. But he that finds it good to look back on what he has done, has a Power

Power of further considering it ; and if he thinks it *good to do better*, he has a Power of making *this* his End, and of proceeding, according to Art, to obtain that End ; and, if he likes this Way of Thinking, he has a Power of going on in it in the same manner To-day as Yesterday, and To-morrow as To-day.

PHILOSOPHY is nothing but the LOVE OF TRUTH ; and he that does not know how to pursue TRUTH in the Way of INDUCTION, as well as in the Ways of SYNTHESIS and ANALYSIS ; in short, he that is not Master of all these Ways of proceeding, is *no Philosopher*. He that is so, is a *complete one*. | And can you think the old Stoics were not ? *Xenophon* and the late Earl of *Shaftebury* were Masters in all these Ways. But they thought it becoming them to shew it only from the *Effect*, whilst their Eyes were fixed on *that consummate Grace, that Beauty of Nature, and that Perfection of Numbers*, which
is

is not easily discovered in their Writings, but from the Effect of them on the honest Reader.



LETTER XII.

AS for the UNIVERSAL MIND, I know not how it can be better represented, than by comparing it, as one of the Antients has done, to a CIRCLE, or SPHERE, *whose Center is every-where, and Circumference no-where.* At every Center I suppose we are to conceive a MIND joined with an INSTANTANEOUS SENSE or PERCEPTION of all that passes in the UNIVERSE. Of this Mind we are to form an Idea, from that Portion

tion *we* enjoy, as our Mind is conversant about the Objects of Science, or rather we are to take it, I suppose, from those Objects. As the Light of our *own Mind* is common with that of the UNIVERSAL ONE; and as all Science, properly so called, is derived from the Light of self-evident Principles, and indeed virtually contained in it: Hence ΝΟΥΣ, the Word for the UNIVERSAL MIND, seems, properly said, to be ΤΩΝ ΑΡΧΩΝ. And I would define MIND, in the gross, to be THAT WHICH MAKES US CAPABLE OF SEEING ALL TRUTH. For there is something in all Mankind, did they not want *some general Ideas* (as Men who are born blind and deaf, do those of Colours and Sounds), which makes them *capable of perceiving all possible Truth*; or, if you please, of being *omniscient*, were *all possible general Ideas exhibited to their View*, after the Manner

ner of *Socrates's* Questions to the illiterate Person in the *Meno*.

The Question then is, What is THAT, which makes us capable of perceiving all possible self-evident Truths? Or, as every such Truth is a general Idea, the Question will be, *What is that GENERAL IDEA, which runs through all these general Ideas, and is the same in them all, as Three strait Lines including Space is the same in all Triangles?* For *Aristotle* says, Νῆς is εἶδος τῶν εἰδῶν, as it will appear to be, when 'tis considered farther, that the Terms of all Propositions whatever, within the Compass of Science, are εἶδη, or general Ideas. So that, νῆς must be a GENERAL IDEA, not only of such general Ideas, as are self-evident Truths, but of all general Ideas whatever.—And thus the human Mind is δυνάμει πάντα τὰ νοητὰ, as the general Mind is ἐντελεχεία. For what we perceive by Succession, the DIVINE Mind perceives all at once.—And thus,

thus, I suppose, we are to conceive the Forms of Knowledge in *Euclid*, and all other Forms of Knowledge, existing originally together in ONE KNOWLEDGE, in this Center where I am, that where you are, and everywhere else, and from thence communicated by Piece-meal, as it were, to us.---This will explain, I suppose, the *μονοειδὲς* of *Plato* in his *Symposium*, and the *πολὺ πέλαιος τῷ καλῷ*. By which, I have a Fancy, he hints, that we are here and there, and everywhere, in the Universal Mind, as Fishes in the Sea.

L E T-



LETTER XIII.

AS for the ἐν ENI in that Passage of *Aristotle* (B. 3d, Ch. 6th and 8th of the Soul), I suppose it is to be understood just as that other ἐν ἐνὶ is, which follows the Mixture of the Soul in *Plato*, immediately after the Words μένοντ' αἰών, where the Word ONE seems to fall in very naturally. For here the Existence of temporary Things is set in Opposition to the τὰ αἰεὶ ὄντα, which latter do as truly and properly exist in ONE, as the former do in *Multitudes throughout the Universe*. The same Passage
of

of *Aristotle* is repeated again in the next Chapter, which confirms the above Interpretation in the strongest Manner. For the πάντα τὰ γινόμενα are the Things of Time, or (as *Plato* expresses it in the Passage referred to) they are TIME, where he considers TIME in Opposition to ETERNITY. For as *Eternity* is the Attribute of eternal Things, so *Time* is the Attribute of temporary Things. And if you put Eternity for eternal Things (just as you put Rotundity for round Things) it will be as proper to put Time for temporary Things. And as *Plato*, in this Place, joins Number and Motion with Time, so I think *Aristotle's* Definition of Time is *the Number of Motions*.---But to return to the ἐπιστήμη, which exists in ONE, and of which *temporary* Things are the *Images*, or Copies, and proceed from it. To say it exists *in Time*, is to say it is a temporary Thing; and yet, notwithstanding, it is very proper to

to say, the UNIVERSAL MIND exists before particular ones, whose Being depends upon it. And that it was *at the time that Plato and other Philosophers were on the Stage; and that it will be, when another Plato, and other Philosophers, take their Turn in Life.* But if you leave out the rest, you can't say, that *it was*, or that *it will be*, only that it is. And here it may be observed, that this does not end in mere Theory. Perhaps there is nothing can contribute more to take off our Admiration from that Multitude of particular Forms which surround us, and transfer it to THAT, *from which they are copied, and in which they are summed up in the most perfect manner.* It will surely teach us a Veneration for that Share of *Reason or Understanding*, which we call our own, and make us proud of the little Use of it in the Conduct of Life.

LET-



LETTER XIV.

IF there be a BEAUTY IN VIRTUE, certainly the Mind must have a Feeling of it, whilst it has it under View, no less than a Feeling of Harmony, when presented to the Ear. For the true Speculation of Virtue seems to be rather like the Practice and actually Hearing of Music, than the bare Speculation of Sounds. It must be felt and understood *together*. And we must be, to use the Poet's Expression, *in some measure what we behold*, if it be true, that a Man must be tolerably good, before he can have any tolerable Notion of Goodness.

G

To

To be duly affected with the Beauty of Virtue, as well as to despise, and to raise ourselves above, such Indulgences as are inconsistent with this Character, and be contented without them, 'tis necessary, as well as we can, to take the *Whole of Virtue* in one View. For, as every beautiful Object must be a *Whole*, the Charm of it must arise from the united View of all its Parts.

The WHOLE OF VIRTUE consists in an habitual Disposition of Mind to embrace nothing as good but what is rational, and dictated by the Universal Mind, the supreme Beauty and Source of whatever is beautiful in all Things.--This supposes Liberty and Freedom of Thought in Opposition to Fancy and Opinion of Good in Life, Ease, Pleasure, Riches, a Name, a Character or Distinction among Men, or whatever else is the Object of the selfish Passions. And these Passions, thus reduced, make Way for the
Love

Love of Mankind, and Gratitude to Society, for Generosity, and a Spirit to add to the common Stock of Necessaries and Conveniencies, or Means of Comfort and Enjoyment, disdaining the dishonest Thought of living on the Labour and Acquisitions of others, or gaining the Fruits of Society into our Possession, and then tyrannizing over those who have a less Share of them than ourselves.

But 'tis not enough to consider Virtue thus in itself. We must consider it as *excellent*, and bring it into View with *that* which it *excels* ; viz. compare this Beauty with other Beauties of Nature and Art ; but, above all, with the human Character, as it is varied and diversified in the several Orders and Ranks of Men, from the meanest Peasant to the highest Potentate or Grandee ; and this not only in that State or Nation in which we live, but in others, as well those that are more rude and barbarous, as those

that are more polished and refined. And thus the virtuous Character becomes complete, as well in relation to the *Universe*, as to *Society*. For a Sense of this Beauty and Excellence of Virtue will necessarily produce *Joy and Satisfaction, in that we live among those Orders on which it depends, This will inspire a sincere Love and Adoration of GOD, in whom we thus find Happiness and Rest.*

As grand as this Idea of Virtue is, when we have endeavoured to comprehend it to our utmost Capacity, and as much as 'tis above our Practice in common Life, 'tis certainly necessary to view and contemplate it often, both for the *Attainment* of it in *ourselves*, and for the *Pleasure* of the Contemplation, as superior to that of Mathematical, or other Philosophical Speculation. | For by this means we are more and more convinced of the Reality of its Existence.---Had we but once tasted the Pleasure of good Eating and Drinking, and but a faint Remem-

Remembrance of it remaining with us, it would not be in our Power, though we desired it, to become luxurious, supposing the Means of gratifying our Appetites to be with Difficulty come at, and we had many Prejudices against them.

As to the Subject of HAPPINESS, it never was once a Question with me, Whether God *was happy*. But it has been a very serious one, Whether he was *good*, and what Reason I had to rejoice in his Being. But in this latter Question I have been long quite satisfied. I had never any Notion of proceeding *a priori*. The Question therefore is, Whether MAN is in his *best State*, or *happiest*, by harmonizing with *Nature*, viz. *by entering into that Course of Life, for which, by his Constitution and Make, he finds Nature to have designed him.*—If I had found, *by such a Course*, by thus coinciding with the Design of Nature, I had been *more unhappy than those*

who pay no such Regard to her, the least that I could have concluded must have been this, *That she never meant well to me.* But when I find the contrary, when I find *Good is intended* me, and that this *Good* is in my MIND, which MIND is imparted to me from the UNIVERSAL MIND, and necessarily connected with it, then I consider the UNIVERSAL MIND under the Notion of Good according to *Plato*, or the DEMON of *Socrates* under the Notion of LOVE.

Let Happiness lie in TEMPERANCE, LIBERTY, and HONESTY. This is but the Effect of my own Mind, as it reasons and governs: By this means 'tis *acquired*, and likewise *preserved*. My own Mind, therefore, is the Cause; and the Effect ought to be referred to it: But the Light, the Being of my own Mind, is from a *higher* Cause; and this Cause is what *Plato* calls Good, to which all is to be referred.—And on the other hand, if
all

all be referred to this, and this principally heeded ; the Consequence will be, Temperance, Liberty, Honesty — Happiness.

Virtue



LETTER XV.

NOTES is ἀρχή, or ἀρχῶν ἐπισήμη. The Idea of KNOWLEDGE we may take from *Euclid*, as it is, in general, *syllogizing on Subjects, which, together with their Relations, are always the same, and invariable, from self-evident Principles.* The Soul of the World operating in this manner every-where ; which Operation *Plato*, in his *Timæus*, seems to represent by his Circle moving and communicating with the Center ; Νῆς, says he, ἐπισήμη τε

ἐξ ἀνάγκης ἀποτελεῖται. I can give no other Reason why *Plato* gives us the Formation of a Soul, and accordingly presents us with an imperfect Being, as acting successively, than this; that the Idea of such a Being, as we have it within ourselves, is more familiar to us; and that, from the Idea of such an *imperfect* Being, he thought, we might most easily raise our Conceptions to that which is PERFECT. Thus he lays the Foundation of this speculative Knowledge, as well as that which is practical in the KNOWLEDGE OF OURSELVES.

But to return to the Consideration of Νῆς and ἐπισήμη above, after the Manner of *Aristotle*. And here it is plain, that every *self-evident Principle* must be a *general Idea*, because 'tis a *Medium* by which *general Conclusions* are drawn. I should hardly have made so obvious a Remark, but that, as obvious as it is, it seems to have escaped Mr. *Locke*,
or

or not to have been considered by him in a right manner. He seems to imagine we may have Knowledge of particular Things ; than which nothing can be more absurd. I may indeed know *Particulars*, while I have them *under View* ; but, when they are not *under View*, I am not safe in affirming of them what I did, when they were, being conscious they are subject to Change and Alteration, and to be one time what they are not another. Whereas every Object of Knowledge, I am conscious, *is always*, what it appears to be when under View, that is, *eternal*.

To explain *Aristotle's* Expression---
 Νῦν ἐστὶν εἰδέναι---it seems necessary to consider MIND as *the general Idea of all general Ideas*. And here every *Proposition* in Science, whether Definition, self-evident, or demonstrated, is a *general Idea*. For, as a Triangle is *many Three Right Lines including Space*, so is a Right-angled Triangle
many

many Three Right-lines including Space under a certain Relation. And the 47th of *Euclid* is as much a *general Idea*, as the Definition of a Triangle.

I observed before, that, if we had Knowledge only of *Particulars*, that would not be *Knowledge*; and, could Man go no further in Numbering than *One*, or the Singular Number, *Plato* says, in his *Epinomis*, he would be ἀπρονέστατον ζῶον. Now every *general Idea* necessarily implies the Idea of MANY, as previous to the Conception of it. Take then any Many whatever, 2, 3, 4, 5, &c. what Ideas are previous to the forming my Idea of any one of these MANY? I begin with Two, the most simple; but, before we consider Two Things in *general*, the Matter will be easier, if we consider any Two *Particulars*, *Two Men*, for Example. Here I observe the same Form, the Form of Man, in both, and yet different in
the

the one from the other ; and without these Ideas of *Two*, *Same*, and *Different*, I can't conceive them as *Two Men*. Now, as to *Two Things in general*, here I conceive *Thing* or *Being* as that which is *common*, and *the same*, in both, and as *different* in each, for this very Reason, because they are *Two*. For, if you suppose them not different, they are not *Two*, but *One* ; and if you suppose *Thing* or *Being* not to be common to them both, then neither of them is. Thus by virtue of these Three Ideas joined together, of *Being*, *Same*, and *Different*, I have the Idea of *Two* ; and, by continually repeating them, I have the Ideas of 3, 4, 5, &c. and thus, so far as every general Idea is *many*, so far I have it. — Consider it further as *All*, or *Every*, or a *Whole* ; and then you have the general Idea complete. If you put only *Many*, or even *Infinite*, in the Premises of a Syllo-

Syllogism, there can be no Conclusion.

From the Example of the Definition of ἀσπαλιεύτης, in the *Sophista*, it appears, that the *Definition* of every general Idea is, *what it has the same, or in common, with other general Ideas, and different from them.* And thus, so far as *Definition* implies the Knowledge of a Thing, the general Idea of it is, *Being, Same, and Different.* And in like manner the Knowledge of a particular Thing, *Theætetus*, for Example, implies what he has in *common* and *different* from other particular Men.—And this seems to agree with *Aristotle's* general Conception of physical Things, or Things in γενέσει, the ὙΛΗ, ΜΟΡΦΗ or ΕΙΔΟΣ, and ΣΤΕΡΗΣΙΣ.

From what I have said, you will easily conceive, that THE GENERAL IDEA OF ALL GENERAL IDEAS is the complex Idea of BEING, SAME, and DIFFERENT, joined together. You observe

observe likewise, how ALL KNOWLEDGE is virtually contained in SELF-EVIDENT PRINCIPLES.

The Question is, *What is a Proposition in general*, as every Two Things may be the Terms of a true Proposition, either affirmative or negative, coincident with the general Consideration of the Number *Two*? The Answer to the Question must be taken from the general Consideration of the Number Two.

Now, in every *Two* Things, I consider something as the *same in both*, or *common to both*, as Animal in Man and Bird; Thing or Being, in Two Things in general.—Since then the Terms of every Proposition are Two, they must be either *both different* from that which is COMMON TO BOTH, as Man and Bird from Animal; or *only one of them different*, as Man and Animal, Bird and Animal; or *neither of them different*, and then they are both the same, and only a Re-
petition

petition of the same Idea, as Animal and Animal. Were all Propositions of this last Sort, there could be no Light brought into the Mind. Propositions of the Second Sort are all *affirmative*; Propositions of the First Sort all *negative*.

So that to *affirm one Thing of another*, as Animal of Man, is to say, *it is the same with that which is common to both*. For here the Idea of Animal is found under *both* Terms, and is itself, besides, *one* of them: And to *deny one Thing of another*, is to say, *'tis different from that which is common to both*. — And to affirm and to deny one Thing of another at the same time, both remaining the same, is, in fact, to say, *'tis both same and different from that which is common to both*; or, *that same is different*. — As the Mind abhors this Thought, so 'tis necessarily and gladly determined by the contrary, in all its rational Operations: And the more or less any
Mind

Mind is governed by this *Necessity*, it is the more or less perfect. Only this is to be observed further in a PERFECT MIND, that here all these rational Operations, or successive Views, are swallowed up in ONE.



LETTER XVI.

THE following Questions were very perplexing to the Antients: Whether those *Units* or *Monads*, which they called *εἶδη*, had a *real* Being, so as ever to be the same, and no-way admitting Generation or Corruption? And whether, in Things that were sensible, and came into Being, and went out of it again, these ONES were each of them *divided*, and became *many*, or existed *separate*, and *apart by themselves*, which

which latter (as 'tis said in the Beginning of the *Philebus*) seems impossible?

Xenophon seems to have answered these Questions, in which, no doubt, he had been duly exercised, by making the Human * Mind *equal* to the Divine, and supposing these Ideas to be lodged out of the Reach of all Decay and Corruption in the Divine Mind, and from thence communicated to the Human. This answers the Question, how 'tis they have a most firm and stable Existence; and on this Hypothesis 'tis as easy to conceive, that they may be copied in sensible Things from an ACTIVE MIND, as that *one and the same Idea in an Artist* may be copied in a Variety of *particular Works*.

And on this Hypothesis all those Difficulties, I suppose, which were too hard for the young *Socrates*, in the

* *Xen. Symp.*

Begin-

Beginning of the *Parmenides*, may be obviated.

How different is the modern Hypothesis, now so much in Vogue, from this of the Antients! Those Ideas, say they, are *abstract Ideas*, which have no real Subsistence, and consequently the *Truths* resulting from them (which are taken from Sensation and Reflection, they say) have no other *Eternity*, or fixed *Being*, than what depends on *Men* and *Things*: Take away *Men* and *Things* then, and they are gone too; and even this TRUTH, that God is, has no longer Being. But, according to the Antients, the Case is otherwise. Were there a general Conflagration, and every thing combustible overcome by the Element of Fire; it would be still true, that God is, though there were none to view him; for surely the Spectator does not make the Object. And perhaps to assist their Hearers in this Way of Think-

H

ing,

ing, it was, that the antient *Stoics* feigned a *general Conflagration*.



LETTER XVII.

CREATION is commonly defined to be, *the causing something to exist now, which had no Being before*. But *existing* is implied in *something*, otherwise it is not *something*, but *nothing*; and to make *something* to exist, is to make it *to be*, what it is *already*. But my Pen, which is now between my Fingers, cannot be put between my Fingers: I cannot be brought into this Room, where I now am, by any Power. The Equality of Three Angles of a Triangle with Two Right cannot be made

made to be, though there may be some other Thing prior to it, without which it could not be. My Horse, which is lame, cannot be made lame, though there may be a Cause of his being so ; there may be a Nail in his Foot.— But to be a little more serious.

The Assurance we have of the *Existence of God*, and of *all other Truths*, comes from God. But may not God impose upon us, and give us what Assurance he pleases ? If this Assurance is the Result of his Works and Productions (including ourselves among them), and if these were such as he pleased to make, our Assurance is then what he pleases. But the Case seems to be otherwise.

There are Two Orders of Things, as different from one another as Light from Darkness ; the Things, or the *ARE's*, which have been, and which will be ; and the Things, or the *ARE's*, which have not been, and which will

not be. The former are the γενέσεις, and the latter are their ὄντα, which I have called ARE's.

These ARE's exist in every Step of Demonstration, from the First Principle down to the remotest Conclusion ; or, in other Words, you have the IS, the ON, in every Step ; you have no *Have-been's*, nor *Will-be's*, here. Would it not be fine Sense, if any one should say, " Sir, I assure " you, there has been an Equality of " Three Angles of a Triangle with " Two Right; and you may depend " upon it, Sir, there will be again."

These ARE's are the Objects of Knowledge, and for this Reason *immutable* and *invariable*; because, were all Things *variable* and *mutable*, and were there not something of a *contrary* Nature, KNOWLEDGE COULD NOT BE.

These ARE's, then, depend not upon the WILL of God ; but they depend upon HIS BEING. Every succeeding

ceeding Step of Demonstration depends upon every preceding one; and they all depend upon the * ΤΟ ΔΙΑ ΤΙ ΠΡΩΤΟΝ, the SOURCE OF MIND, the ALL-TRUE and PERFECT. And if the ARE's before-mentioned are not temporary Things, but *eternal*, and *immutable*; if neither any, nor all of them, can have any Being, without the FIRST; then, I suppose, we may conclude this FIRST *εἰς* necessarily is. But this Way of Proof is not *demonstrative*; and as for the *Idea of God*, perhaps the most perfect one may be exhibited from the Consideration of the *Harmony, Union, and Correspondence of Nature*, considered as ANIMATE and INTELLIGENT; but this, surely, will never be admitted by any honest Lover of Truth, till he sees it perfectly answer to the best Knowledge he can get of the Things within and without him, of the οὐρα and γενέσεις.

* *Aris. Met. p. 842. Edit. Du-Val.*

According to the Moderns, God is FIRST, and TRUTH is LAST. In the first Place are *Ideas*; these arise from our Faculties, and the Nature of Things without us. The Make of our Faculties, and of the Things without us, is from God; and God made all Things from Nothing, when He pleased, and as He pleased. According to the Antients, GOD is FIRST, and TRUTH comes immediately from him, not by the Medium of his Works, operating on our Faculties; nor has its BEING any Dependence upon our Faculties. GOD is the immediate Cause of our Ideas, and the Truths resulting from them: And the Make of our Faculties, and of outward Things, is according to *original Ideas of the same Kind with those which are originally, and a priori, imparted to us*; TRUTH proceeding not from these, but these from TRUTH.



LETTER XVIII.

I May now, in some measure, be as good as my Word to you. For, having lately read Dr. *Cudworth's* posthumous Treatise on eternal and immutable Morality, or, as it may as well be called, on eternal and immutable Mind, all drawn from the antient Sources; I have taken Occasion to recollect some Things, which, I think, I have observed in these old Authors upon the same Subject, into which I find the Doctor has gone no farther than the Question, *Whether it is*, leads him. As to the Question, *What it is*, he has remarkably past it over, tho' it

is the main thing in View in the *Theætetus*.

For the Question there, Whether Knowledge be Sense (with which the Doctor is intirely taken up), is in reality but a Question, *Whether it is at all* ; and is only introduced as preparatory to this other grand Question of the Antients, *What it is*. Perhaps the Doctor might not think it worth his while to throw away so much Time upon it, as might seem necessary, since he is in this Dialogue told by *Socrates*, that many Sages of old spent almost their whole Lives before they could determine the Point ; or, perhaps, the Curiosity might seem vain ; and, without this Academic Scepticism, he might think himself sufficiently knowing in it ; which is not unnatural to suppose. This we find was *Mr. Locke's* Case ; and, upon the Whole, he may be better excused than *Dr. Cudworth*. Mind, with him, was

was a made or created Thing; and therefore carried no more *Divinity* in it, than *the outward sensible World*, on which he rather bestows *real* Existence, than upon his own Ideas, which are little more than a Copy of it.

To explain therefore the Beauty of universal Nature by any Essay of this Kind, cannot be supposed to have been in his Thoughts. Nor had he, like the Doctor, *present Divinity* to inspire him.

When we are given to understand by *Pythagoras*, in his mysterious Way, that KNOWLEDGE is the *Harmony* of Ideas, we take no Notice of it, except perhaps as it affords us Diverſion.—But when we are told by a *Locke*, that KNOWLEDGE is the *Agreement and Disagreement of Ideas*, and have it immediately explained to us, without the least Mystery, wherein this Agreement and Disagreement consists, by enumerating the
Sorts

Sorts of it ; we are serious, and give up our Attention and Assent, in a manner, together, admiring the Clearness of the Writer : For this Character, I think, is universally given to Mr. *Locke*, considering, as they say, the abstract Nature of his Subject. Whilst poor Dr. *Pemberton* lies in Disgrace, for his vain Attempt to explain *Newtonian* Philosophy to fine Gentlemen and Ladies, we find the Name of Mr. *Locke* still highly honoured, for bringing down to the Level of ordinary Capacities a *Philosophy* of a much *higher Nature* ; and which, one would naturally think, took place in the Mind, after that, and other *Philosophies*. At least, it seems not easy to conceive, but that there must be Knowledge or Science of divers Kinds in the Mind, as Subjects to be observed and speculated upon, before there can be a thorough Knowledge of *this* Knowledge ; as we suppose

pose there were Songs and Tunes in Being, before there was a Canon and Art of Music.

Theætetus, being asked, *What Knowledge* was, answers by *enumerating* the Sorts of it in Mathematics, Arithmetic, Geometry, Astronomy, Music; which was very generous in him (says *Socrates*), when he was asked only one, to give many.---The Question therefore, it seems, was, *What was that, which was ONE and the SAME in MANY.*---This forward Disposition of the human Mind to enumerate, and give the *Sorts* of a Thing for the Thing *itself*, is noted by *Plato* in other Dialogues, besides this of the *Theætetus*; and from what he says of it in his Seventh Epistle, we may, perhaps, collect the Reason for his writing on this Subject in a concealed Manner.

But it is not always that we are thus disposed to *enumerate*, and thus delight in Numbers. We are often
averse

averse to the Work, even when there is an absolute Necessity for it. Of this, our Way of considering this Question, whether the Axiom, *It is impossible for the same Thing to be, and not to be*, be the Principle of Science, is an Instance.---Here, it is evident, we are averse to that Arithmetic which is so natural upon other Occasions; and yet, to deal fairly with this Question, what can we do less than *enumerate, distinguish, or define*, such Particulars as these? *viz.* BEING *absolute*, as it is opposed to *Non-entity*; *relative*, as when we say a Thing is, or is not, with regard to some other Thing; and as this runs thro' every Proposition, *Proposition itself*; *its Terms, general and particular*; BEING *variable and invariable*; *Science, Opinion*; *PRINCIPLES, same and different*; and abundance more, which such Particulars would, one after another, introduce, but which it may seem even trifling to mention,

mention, if *Aristotle's* Remark will hold good in our Days, *That, in this respect, we are like Gentlemen of great Estates, who think it beneath them to be exact in their Accounts.*

The *Lockists* say, it is impossible to form a general Idea without Time, and successive Thought. Nor will it, I suppose, be denied them, that we must have many Ideas in our Mind, before we can see *that, which is common to them all.* But the Conception of them, as they are all *one*, is by a *single Cast* of Thought, which has nothing to do with *Time*, any farther than it comprehends all the successive Views of those particular Ideas, on the Sum of which it was raised into the Intellect. For I do not understand this Proposition, *Three Right Lines, including Space, are Three Right Lines, One of which is less than the other Two;* unless I see, that *ALL Three Right Lines, including Space, are Three Right Lines, One of which is less than the other*

other Two; and am certain, *that there are no Three Right Lines, including Space, of which this shall not be said; i. e.* I do not understand the Proposition, if I do not understand it as *general*. For * *Universality*, according to *Aristotle*, is, when one cannot take any thing of the Subject, of which the other Term shall not be said.

Were the Universe stuck with Triangles To-day, and others to take their Place To-morrow, these are only some of those, that fall within the Limits of the Affirmation before-mentioned. So that, had I an enlarged Sense (like *Milton's Prayers*),
di-

* This *Universality*, perhaps, is the *Cartesian Infinite*; which they define to be, *that which has nothing beyond it*, as they do *Finite*, that which has *something beyond it*: In which their Language, like that of *Homer's Gods*, differs not a little from that in common Use. Here, on the contrary, *Finite* ($\pi\epsilon\rho\alpha\varsigma$) is that which has nothing beyond it, as *Infinite* ($\alpha\pi\epsilon\rho\epsilon\upsilon$) that which has *something beyond it*. *Analyt. l. 1. c. 1.*

dimensionless, to penetrate the Universe, and bring Home to my Mind all those sensible Triangles, which formed the *Pythagorean* Element, that formed every-thing else; I should find I had a Standard within me, to measure and judge of them all. For it is not with the MIND as with the *Eye*. The *Eye*, unless you suppose it new-formed, must travel from Place to Place to take a View of the *sensible* World; but the MIND, by its *present Strength and Capacity*, tho' confined to a Point, takes a *boundless Survey of that which is intelligent*.

If it be said, that some of these Triangles are too minute, as others may be too big, for the human Mind to lay her Hold on; it cannot, however, be said, that this takes from her *Knowledge*, but only from the *Use* and *Application* of it: In the same Manner as a Man that understands Optics, by losing his Sight, would
not

not be said to lose his Knowledge, because he could not now apply it to *Particulars*; especially if it were *thorough Knowledge*, and he were certain that no Particular could exist, of which he had not a *Rule* and *Measure* in his *Mind*. For, in reality, all particular Existences, whether within or without the Mind, do rather seem to come under the Head of Sense, than Knowledge *; and are to Knowledge, as a *Thing* measured to its *Measure*.

There are some who seem to have a Notion, that the Objects of Knowledge are spun, as it were, out of the Bowels of *Particulars*. And, with regard indeed to the Order in which Things become known to us, *Particulars* are, without Question, *first*. But then this is not the Order of Nature. Here, that which is *most general* is *first*, and *most real*, and (if

* Τα γὰρ καθόλου, ὡς περ αἰδημένα ἐστὶ, πλὴν ἀνεν ὄντος. *Arist. de An.* l. 3. c. 9.

(if I may so say) *most knowable*; and that which is less general, and subordinate, less so.---In this Syllogism ---*Every Three Right Lines, including Space, are Three Right Lines, One of which is less than the other Two. The Word Triangle signifies Three Right Lines, including Space: Therefore the Word Triangle signifies Three Right Lines, One of which is less than the other Two.*---I say, in this Syllogism, that which is First in the Order of Nature, is *Three Right Lines*; *One of which is less than the other Two.* This may be in many Minds, where *Three Right Lines, including Space*, have no Being: But where-ever *Three Right Lines, including Space*, are, there of Necessity *This* must be. For, on Supposition that One of the Three Right Lines, is equal to, or greater than, the other Two, the included Space is no more. And, in like manner, the Being of Three Right Lines, including

I ing.

ing Space, is prior to the naming it. And thus the Cause of all is that which is *most simple*, and *most general*. As to the Conclusion, that is seen, not barely by perceiving the Agreement of Ideas in the First and Second Proposition, but by apprehending the First, as it is general, and the Second contained in it, as such.

Let this Proposition, Every *A* is *B*, be any known Truth. Perhaps, when I first consider it, and assent to it, I have not a Thought of *A*, as blended or compounded with any other Ideas. But when I discover it thus compounded (however unexpectedly) by the Help of some minor Proposition, I find myself all at once acquainted with it. I see it to be *B* too; because I knew before, it could have no Being, but it must have *B* cleaving to it. And were *A* ten thousand Ways thus hid and buried amongst other Ideas; and had I as many minor Propositions, every one of

of them general, to produce into Light; I should see all these general Propositions within this *most* general, *most* simple, and *first known* Proposition, *Every A is B*, as ONE and the SAME STANDARD to them all.

All *universal self-evident Propositions* are, in this Sense, FIRST: And the Mind, understanding all Truths of this Kind, as soon as proposed, and all Truths being virtually contained in the FIRST, she is capable of all Knowledge, and, by her natural Light, a Judge of all. For if, at any time, she wants Sense to awaken some general Ideas in her, this implies no Want of Capacity to understand them.

Such is the Nature of the human Mind.---So that, were the Blood and Spirits of a Child settled, and his *inward Eye* strong, so as not to be dazzled with *intellectual Light* and *Colours*; but to view them with Ease and Pleasure (as Children naturally

delight in seeing new and strange Spectacles) ; and were some DIVINE BEING likewise to present it with Shew after Shew, in a regular Manner (much better, we will suppose, than *Socrates* proposed Questions to the illiterate Person in the *Meno*) ; it is not difficult to conceive how he might, at last, become Master of more Knowledge or Science (in the modern Sense of those Words) than ever was in the Mind of any Man, or ever will be in the Minds of all Men ; and that in a very short Space of Time, long before he reached the Age, and, I may add, the Ability and Capacity, of Manhood.--But, by the way, what an Idiot (and withal how conceited) must this poor Creature be, as to all valuable good Sense, the KNOWLEDGE of this Knowledge, as it is in itself ; or as valuable in Life, Prudence, Wisdom, or Discretion, or whatever it be called, that comes only into the Mind with Time,

Time, Observation, and Experience; particularly in the *Study of ourselves*, as moral Agents, drawn by Affections, and determined by *apparent Good and Evil*; in short, as to all that is most solid, and essential, in genuine and sound Philosophy! When one considers how difficult it is to get rid of this childish Part, and what a Figure it often makes in our Scholar Character of a great Man, one is better reconciled to *Xenophon*, and less offended at him, that his Character of *Socrates* is not so shining a one in this wonderful Way.

If you will pardon this Digression, I will endeavour to keep more close to my Subject in what remains. Only, if I dwell a little on the *Parmenides*, it will not be so much out my Way, nor, I hope, disagreeable to you, as I remember I once found you had been thinking about the Nature of this Dialogue. Dr. Cud-

worth, I find, with the Archbishop of *Cambray* and others, is of Opinion, that *Aristotle*, either unjustly or unskilfully, *attributes* to *Plato* the Doctrine of Ideas.

This Notion, we learn from *Aristotle*, was first introduced in Opposition to a Philosophy, which held, that all Things were *sensible*, and *variable*. If it were so, Knowledge could not have been. There were therefore *immutable Natures*, called *Ideas*. Upon these Ideas, those by which we understand depended, tho' the other existed apart from them, and had nothing in common with them, agreeing only in Name; and therefore called homonymous, as *Callias*, and his Statue, or, in *Spinoza's* Words, *Canis animal latrans, et Canis Signum cœleste*. For such, it seems, according to the last Author, is the Divine Intellect, compared with the Human, against a fundamental Principle of his own, *That Things*

Things which have nothing in common cannot understand one another. Parmenides, indeed, on Supposition of homonymous Ideas, seems to have shewn such mutual Understanding to be impossible. And, on this Supposition, is it not as absurd to pretend to learn Divine Understanding from our own, as to learn the Animal Oeconomy by the Dissection of a Statue ?

In Defence of *Plato* the Doctor quotes the Authority of *Socrates* in the *Parmenides*. But, with Submission to the Doctor, poor *Socrates* has no Authority here at all. On the contrary, he is honestly and fairly confuted. He is not the Hero here, as in the *Theætetus*. There is not even poetical Probability for it. For as that Conversation, which was left to go about the Business of his Accusation, was in his latter Days ; so this was, when he was very young. And accordingly we find in him a youthful Forwardness to dispute, ig-

norant of himself both as to his Capacity in this respect, and thinking himself knowing, where he was far from being so.

As *Aristotle* will have this Principle, *It is impossible for the same thing to be, and not to be*, the fundamental Principle of Science; so, he says *, were Contradictions true, a Gally, a Wall, a Man, would be *one*, and the *same*.

Zeno, in the *Parmenides*, denies the Being of *many*; for then Things would be like and unlike at the same time, which was impossible. Had *Socrates* been Master of *Dialectic*, we can't suppose he would have had recourse to homonymous Ideas, nor have gone about to explain Likes by Likeness, and Unlikes by Unlikeness (*Triangles*, I suppose too, he would have explained by *Triangularity*). Possibly he would have begun with

* *Metaph.* p. 875. Ed. Du-Val.

Zeno,

Zeno, in the way of Induction from many particular Instances of Likes, to strike out the Definition of Like, as that which was common to them all, and so of Unlikes ; and then have shewn it was very natural for the same thing to be like and unlike in different respects, and have drawn *Zeno* into a Contradiction, if he had held out : And, if he still persisted, and disallowed this Method of proceeding, he would have taken up the contrary Hypothesis, as *Parmenides* himself afterwards does, That *One is* ; and then from hence have shewn the Being of Many, the Being of Same and Different, and, lastly, of Like and Unlike ; till at last, from *Zeno's* Concessions, he could define Many, or the *Ones of Many*, by shewing what that was, upon which the Being of every one of them depended ; and then the Business was done.

Parmenides,

Parmenides, it is true, has gone farther ; but the plain Reason of this is, That *Socrates*, in the Beginning of the Conversation, introduced homonymous Ideas. This made it necessary for *Parmenides*, without regard to any such immutable Natures, to prove the Being of the general Heads of Predication of those Ideas, on which the very *Being* of Science and Philosophy, or Dialectic, depended. And thus, I suppose, it is, that *Plato* has made way for the following Doctrine of his old Pupil : “ * That there should be “ Ideas, or some One Thing besides “ Many, is not necessary, if Demon- “ stration is : But that it should be “ true to say One of Many, is in- “ deed necessary. For General will “ not be, if this be not ; and, if “ General is not, then a Medium will “ not be, and so no Demonstration.

• *Analyt. Post. l. 1. c. 11.*

“ There

“ There must therefore be, in Many,
 “ *One and the same*, not homony-
 “ mous.” This seems to be the Sense
 of *Plato* in the *Epinomis*, where he
 says, “ No living Being, which knows
 “ not 2 and 3, and is altogether ig-
 “ norant of Number, can be capable
 “ of giving a Reason concerning
 “ those Things, of which it has only
 “ Sense and Memory.”

In the Words immediately pre-
 ceding the translated Passage above,
Aristotle, speaking of *Terms*, says,
 they are neither as a *Whole*, nor
Part: And before, in the same
 Chapter, he says, they are not *Hypo-*
thesis; and in Chapter the 3d, of
 the same Book, he asserts dogma-
 tically, not only that there is a
Knowledge of immediate (*ἀμέσων*) *in-*
demonstrable Propositions, but a PRIN-
 CIPLE of this Knowledge. This *Prin-*
ciple he commonly calls INTELLI-
 GENCE; and he says, *Intelligence* is
 of

of *Terms*, of *First* and *Immutable*
-*Terms*.

So far, then, *Terms* and *Many* agree, that they are alike *prior* to these *general, immediate* Propositions: And they seem likewise to agree in this; That as *Terms* are not as a *Whole*, nor *Part*; so neither is *Many*. For tho' every *All* is *Many*, yet every *Many* is not *all*; and yet were *many* the same with *some*, it would carry the same Sense to say, all is *some*, as to say all is *many*. As there are Two *Terms* to these immediate Propositions; there are likewise *Two Many's*. *Every one* of the general Propositions of Science, as it stands actually formed in the Mind, is certainly ONE, εἰς λόγος, as the Predicate is the ONE Thing said of the Many of the Subject. But *Terms considered in themselves*, and antecedently to the Affirmation of the Proposition, are of Necessity both alike *many*. For the Predicate is the Cause that the Subject is at all; and, consequently, that
it

it is many; and must therefore be itself many. If there is not *One Three Right Lines, One of which is less than the other Two*, then there is not *One Three Right Lines, including Space*; and if only *One of the Former*, then only *One of the latter*; and if only *Two*, then only *Two*. And as there can be no *Three Right Lines, including Space*, but there must be *Three Right Lines, One of which is less than the other Two*; of Necessity there must be as many of the *latter*, as of the *former*, original and independent: And, notwithstanding the Proposition (as it stands actually formed in the Mind) is in itself *simply and individually one*, in the Sense above; yet, if we look into it, as a Mixture or Composition, we find it to consist of *Two Many's*, One of which is *many Three Right Lines, including Space*; and the other, *many Three Right Lines, One of which is less than the other Two*.

As

As to *Hypothesis*, it is a general Proposition, not necessary to the learning a Thing: In this it differs from *Axiom*; without which, as in Geometry for Instance, its Demonstrations cannot be learnt.----And *mathematical Axioms* themselves, as they are not necessary to the learning Things out of their Province, and as they *suppose* Things, without *determining their Being and Nature*, are simply, in the Account of *Plato*, *Hypothesis* too.----As far then as MANY is necessary to understand at large, so far is it NON-HYPOTHESIS, ἀνυπόθετον.

Term then, and *Many*, being supposed the same, that, by which we understand *Terms*, and that, by which we understand *Many's*, must be one and the same. Thus as *Plato* leads you up to his *Region of Intelligence*, by the Help of mathematical Sciences; so *Aristotle*, by an Art or Science principally formed on the Speculation

Speculation of those Sciences, brings you up to the Top of Science.---Nor does it seem any-ways absurd to attend him thus closely, as his peculiar and distinguishing Character is Accuracy or Exactness, τὸ ἀκριβές. As to what remains of INTELLIGENCE, what it is, and as it stands in that ONE BEING, *which is every-where the same*; this, I suppose, belongs to Metaphysics. Only in the concluding Chapter of his Analytics, and likewise in his Ethics, as it is the Principle of Science in Man, he tells us, it is discovered by *Induction*. By which, from what has been said, what else can we conclude him to mean, but that, from particular Observation of some of those εἶδη, MANY'S, FIRST TERMS, into which *all Science is resolved*, we are to collect *that which is common to them all*; or the IDEA of those IDEAS, as it is *one and the same* in Many itself; or the ONE THING said of every One of Many, *without*

without which no One is ? For, in his Treatise of the Soul, he says, INTELLIGENCE is the IDEA OF IDEAS, which is likewise an old *Pythagorean* Definition of *Monad*.

Whatever were the Mysteries wrapt up in common Numbers by those primitive Philosophers, there was little of Mystery, however, in what they said of Number and Arithmetic at large.

They considered all Things as *continuous* or *discrete* : Under the *former* Notion, they conceived *the Universe itself*, with all its Parts, as *intimately united*, and mutually embracing and supporting each other *naturally*, as a *real* Tree, not as a Thing in *Wax*, of the same Figure : Under the *Latter*, its *Beauty*. The former was the Subject of *Geometry*, the latter of *Arithmetic*. And in this Division they are followed by our Mathematicians to this Day.--- For they tell you, *That which is continuous,*

tinuous, and has its Parts united, is Magnitude, and the Subject of Geometry; and that which is discrete, and has its Parts separated, is Multitude, and the Subject of Arithmetic.

Now, according to *Plato*, there are *Two* Multitudes, distinguished by the *ONES* in each, which were either *unequal* or *different*; or *equal* and *the same*. The former was the Subject of the *Arithmetic of Philosophers*, the latter of the *Many*. And is not this literally true?

For, I suppose, it will be allowed, there are no *Two* Ideas, but what are different. If this be denied, I reply, they are not then *Two*, but a *Repetition* of the same Idea, or rather, *Two Views* of the same Thing. Leave out this *different Relation* of one Thing to another, and consider each only as it is called *One*, and you have *Euclid's* Definition of a vulgar or mathematical *One*, or *Unit*; viz. *That according to which a Thing is*
K
called

called One. This Division of Arithmetic *Plato* seems to have had from the *Pythagoreans*. For amongst the Ruins of this Philosophy we find there were *Two Arithmetics*, the one *absolute*, the other *relative* (which latter was called *Harmony*); and, in this Sense, probably, we are to understand the Numbers of the SOUL.

But *Aristotle*, it may be said, does not recognize this *philosophical* Arithmetic.

It would take up too much Time to reply fully to this. In the first Place, he has nothing to say against it; and, in the next Place, it may be considered, that as his *Metaphysics* are a Speculation, which naturally takes place after *Physics*, he takes in the very Discussion of this Question; *Whether there is such a general Science or not?* That there is such a one, he gives his Reader plain enough to understand, and that the Subject of it is ONE and MANY; to determine this
Matter

Matter dogmatically, in a formal Manner, was far from the Genius of his Metaphysics, which are altogether of the *pirastic* Kind, and, perhaps, at the Bottom, no less mysterious, than the Numbers of *Pythagoras*; only more simple, and natural, and more becoming Philosophy, when she was full grown, and had learnt to form her stammering Tongue to the uncouth Language of *Dialectic*.

The Knowledge or Comprehension of this Universal Arithmetic, according to *Plato*, belongs to *Dialectic*; and therefore, when he comes to define that Knowledge, which makes the distinguishing Character of the *Philosopher*, or Master of *Dialectic*, we find the Objects of it are altogether of the *discrete* Kind. * For
 “ he (meaning the Philosopher) is the
 “ Man, who sufficiently sees one
 “ Idea every Way extended through
 “ many, every one of them lying

* *Plat. Sophist.*

“ apart ; and many Ideas, different
 “ from one another, externally com-
 “ prehended under one.---And fur-
 “ ther, one Idea, throughout all
 “ Manys, wrapt up in one ; and
 “ many Ideas every Way separate or
 “ discrete. This is to have the
 “ Knowlege to discern, how Ideas,
 “ as they are general, agree and
 “ disagree.”

This Passage, as it is dropt in by
 Chance, and as it were in Play, may
 at first seem not to deserve much
 Notice. But if we consider the
 Manner of the Author, it may, for
 this very Reason, perhaps, deserve
 the more Attention. It may be
 in the best Situation he thought
 he could give it ; for, as to the first
 Part of it, have we not here *the*
Whole of Science ? and in the latter,
 Intelligence itself ?

Aristotle's general Form of Science
 is this : Every *A* is *B* ; every *C* is *A* ;
 therefore every *C* is *B*.---And by
Aristotle's

Aristotle's own Doctrine, the first Two Propositions, as they are *general*, suppose *one and the same in many*, one and the same *B* in many *A*, and one and the same *A* in many *C*; and as for the Conclusion, that follows of course. And what is it to say, *it follows*, as we call it, but to see *B* in many *A* *unmixt* with other Ideas, and likewise with many *A* *mixt*, as represented in the minor Proposition? ---And thus *Aristotle* must allow, that the Whole depends upon Multitude. And if ARITHMETIC has this for its Subject, it may not improperly be called the SCIENCE OF ALL SCIENCES.

But *Plato* speaks of seeing *one and the same in many*, comprehended under *one*: And if by this we are to understand the Many of one general Proposition comprehended under the Many of another Proposition, how does this agree with his Expression? *For many under many is not many under one.* To this I shall only say, that

he adds the Word *externally*; which may be allowed to hint thus much, that we are not to understand the Many to be comprehended *internally*, as a *Mixture in an Ingredient*, a Metaphor he had been using before; and that One agrees well enough with the Idea of *General* or *Whole*; and lastly, that a little Shade might seem to be exceeding proper.

As to the *Disagreement of Ideas*, *Aristotle's negative Form* is this: Every *A* is not *D*; every *C* is *A*; therefore every *C* is not *D*. But, it is evident, the affirmative Form is original to this, and therefore by *Aristotle* called ἀρχαιοτέρῃ. I suppose *A* and *C* to stand for the same here, as before. That which is one and the same in many *A*, is here supposed, *viz.* *B*. And it is upon the Difference of *D* and *B*, that the Negation, thoroughly understood, depends. And, consequently, since it appears by the *Affirmative Form*,
that

that every *C* is *B*; without this negative Form it must appear, at Sight, that every *C* is not *D*, and that more clearly than can be shewn by the negative Form.---So much then for the former Part of this Passage of *Plato*.

As to the latter Part, ONE IDEA THRO' ALL MANY'S WRAPT UP IN ONE, what else can it be, but *Aristotle's* INTELLIGENCE?

As this Idea is situated in a very BRIGHT PLACE, which the Eyes of the Many cannot look up to; and as we have here the distinguishing Character of the Philosopher, which, according to *Socrates*, in the Beginning of the Dialogue, is not much less difficult to be comprehended, than that of GOD himself; and especially if we consider this Dialogue of the *Sophista* and *Theætetus* in one View, as they are plainly one at the Bottom; is it not here that we are to conceive this Idea, as in that ONE,

K 4

whose

whose * *Center is every-where, and Circumference no-where*; and which, to the Philosopher's Eye, carries every-where the same Face; as he finds, go where he will, the same Genius always present with him?

----- *God in Heav'n Is Center; yet extends to all.*-----

Par. Loft, B. IX. l. 107.

But to return to the philosophical Arithmetic mentioned above.

It may be asked, perhaps, how it is that mathematical Arithmetic and Geometry differ, since they are both

* Ὅλον, ὡς πρὸς τὴν Παρμενίδους λέγει, Πάντοθεν ἐκκύκλις σφαίρας ἐγαλίχγιον ὄγκῳ Μέσσοθεν ἰσοπαλὲς πάντῃ. Τὸ γὰρ ἔτε τι μᾶλλον Οὐτε βεβαιότερον πέλει. *Sophista.*

Can there be a firmer Foundation of the Whole conceived, than this equal Opposition of all the contrary Forces of Nature meeting every-where as in a Center?—Nature being every-where thus self-balanced, seems to be at no Pains to support herself.—And can there be any-thing greater? Παρὰ δὲ τὸ πᾶν καὶ ὅλον, ἔστιν ἕξωθεν τὰ πάντες, says *Aristotle* in his *Physics*, p. 357. just as he expresses his Notion of Universality.

both alike comprehended under *philosophical Arithmetic*, as they are Sciences, and proceed alike by general Ideas? I answer, they differ by the Ones of *their respective Manys*; which in Geometry are *continuous*, in vulgar Arithmetic *discrete*.

Thus vulgar Number itself (which is defined to be a Collection of Units) as it is a general Idea, is many Collections, consisting each of *discrete* ones; whereas many Three Right Lines, including Space, are many continuous Ones.----Only, perhaps, an old *Pythagorean* might object, that *the Ones of all Arts and Sciences, besides those of vulgar Arithmetic*, and the Applications of it, being of the *continuous Kind*, they were all comprehended under *Geometry*; that he might with the better Countenance represent the Universe, by *Points, Lines, Surfaces, and Solids*; *Point*, by One; *Line*, by Two, and likewise by Three; *Surface*, by the Square of 2
and

and 3, viz. 4 and 9; and *Solids*, by their Cubes, 8 and 27.

It was necessary to add the *odd* to the *even* Number, otherwise you had not the Whole of Number, or of what might be represented by it. All the other Divisions fell within the Compass of 1 and 27.

In *Timæus* there are Two more intermediate Terms or Divisions, than in *Plato*; that they might be in all 36 to represent the Circumference of the Heavens, which was 36 Decads; but in *Plato's* Way of painting there was no Occasion of this Emblem. His Circle served in the stead of it.

I take it for granted, it will appear, by comparing *Timæus* with his Representative in *Plato*, that the Ingredients of the Composition of the Soul are *one* of them, *Being, same, different*, and INVARIABLE; the *other*, *Being, same, different*, and VARIABLE.

We

We are likewise given to understand, that the *human Soul* is of the same Form with that of the *World's*; and that it consists of one Part, which is *more excellent*, of the Nature of *same*, viz. INVARIABLE; and another *less excellent*, of the Nature of *different*, viz. VARIABLE.

Aristotle's prime Divisions of the rational Part are, *Intelligence*, *Science*, and *Opinion*. The Two latter he distinguishes by their Objects. Those of *Opinion* are, *such as may be otherwise*: Those of *Science*, *such as may not be otherwise*. And as for INTELLIGENCE, that he places at the HEAD of Science, and not improperly; as it is also with him the Name of that which is SUPREME and FIRST in Nature. For, according to * *Plato*, the Objects of *Opinion*, to those of *Science* and *Intelligence*, are but as the Shades of visible Things, or their

* *Reip. l. 6. ad finem.*

Images in Water, Glafs, or Metal,
to the Things themselves.

In the formed Soul of the World,
it was natural there should be *Imper-*
fection, such as this of *Opinion*, and
ſucceſſive Thought. But it was more
easy to proceed from *our own* Soul to
an *universal one like it*, and from
thence to *that which was perfect*,
than it was at once to form (as they
call it) the Idea of a PERFECT BEING.

Immediate are the Acts of God, more ſwift
Than Time or Motion; but to human Ears
Cannot without Proceſs of Speech be told;
So told, as earthly Notion can conceive.

Milton's Par. Loſt, B. VII. l. 176.

I have uſed the Words *variable*
and *invariable*: Perhaps diviſible
and indiviſible, or ſeparable and in-
ſeparable, may ſeem to expreſs the
Thing more properly.

The Being of a Triangle being
ſuppoſed, it is impoſſible to ſeparate
from the Idea of it that of Three
Right

Right Lines, one of which is less than the other Two. A Man taking Opium may be without sleeping; and so may Gold heated be without melting, as, for ought we know, melting may be without that.

As for those POWERS, which in *Timæus* are called PRINCIPLES of Motion, I suppose it may appear, by comparing again *Plato* with him, that they are *same*, and *different*. And what says *Aristotle* of *Principles*? That they are * contrary: That all Contraries are comprehended under ONE and MANY; that to ONE belong *same*, *like*, and *equal*; to MANY, *different*, *unlike*, and *unequal*.

But *Unlikes* and *Unequals* are comprehended under DIFFERENT, as *Likes* and *Equals* are under SAME, just as *Quantity* and *Quality* are under BEING †.

* *Met.* p. 871.

† Κατὰ γὰρ τὸν τῆς ἑσίας ΛΟΓΟΝ λέγεται τὰλλα ὅτι, τό τε πῶτον, καὶ τὸ πῶτον, καὶ τὰλλα τὰ ὅπως λεγόμενα.
Met.

In the most general Conception of ONE and MANY, to *Many* belongs DIFFERENT ; to *One*, SAME. But *Aristotle* says again, ONE is the *Measure and Principle of Many*.--- He says too, MEASURE and PRINCIPLE is *that by which we understand a Thing* * ; ὃ πρῶτον γνωρίζουσα.

Let us consider then in this View his *first Many*, πρῶτον πλῆθος, Two in general, or *Two Things*, or *Beings*.

As they are *many*, by what has been said, they are different ; for, if they are not different, I can't understand them to be many, or Two. But they are likewise, each of them, *one Thing*, or *Being*, and Being is *same* and *common* to both ; otherwise I can't understand them to be. To each of them likewise, as they are one, belongs the Idea of indivisible. To *One* therefore in general, as it enables me to number, and as it is the

* *Met.* p. 888.

Measure of Multitude, belong the Ideas of Being, Same, Different, and Indivisible.

Supposing this Idea to be the Mixture of the old *Timæus*, as it comprehends under it all *Plato's* Manys, πάντες οἱδε λόγοι, just after, will not appear so shocking.---For does he not, in effect, say to his Reader, *I have given you the whole Materials of the rational Mind?* I require you to strike them out in that Form, according to Science; just as I propose to you this Problem,

To divide this Sum of harmonical Proportions 114695 into 36 Terms, according to the Rules of Music.

Quite contrary to what has been advanced, * *Spinoza* says, God is

• This Philosopher, after a Run of no less than 73 demonstrated Propositions, all derived from self-evident ones, tells you, he has now shewn the Cause of those common Notions, which are the Foundation of our Reasoning; that is to say, he has DEMONSTRATED that which is impossible to be demonstrated; which is prior to all Demonstration; and without which no Demonstration is.

im-

improperly called one. His Words are, * *Porro, quod demonstrationem attinet, quam ego in appendice geometricarum in Cartesii principia demonstrationum stabilio; nempe Deum non, nisi valde improprie, unum vel unicum dici posse; respondeo, rem solummodo existentiae, non vero essentiae respectu unam vel unicam dici: res enim sub numeris, nisi postquam ad commune genus redactae fuerunt, non concipimus. Qui, verbi gratia, sestertium et imperialem manu tenet, de numero binario non cogitabit, nisi hunc sestertium et imperialem uno eodemque, nempe numerorum vel monetarum, nomine vocare queat: nam tunc se duos numeros vel monetas habere potest affirmare; quoniam non modo sestertium, sed etiam imperialem, nummi vel monetæ nomine insignit. Hinc ergo clare patet nullam rem unam aut unicam nominari, nisi post-*

* Op. Post. p. 557-8.

quam alia res concepta fuit, quæ (ut dictum est) cum ea convenit. Quoniam Dei existentia ipsius sit essentia, deque ejus essentia universalem non possumus formare ideam, certum est eum, qui Deum unum vel unicum nuncupat, nullam de Deo veram habere ideam, vel improprie de eo loqui.

Strange, that there should not be an Essence of Ones, as well as of other existent Things!—Tho' God is not ONE of Many, nor many Gods; yet, as he is the Cause that everything is One, whether *Essence* or *Existence*, it is not, surely, improper to say, he is One in this other respect. *Τὸ πᾶν ἐστὶ ἐνοποιητὸν*; says *Aristotle*, in his 1st Book of the Soul, c. 7. He answers, *Τὸ δ' ἐν ποιῶν, τὲ το ὁ νῦν ἵκατο*. B. 3. 7.

Aristotle, in his *Topics*, Book 6. Chap. 3. says, It is difficult to explain whether the Definition of the Soul by Number, added to Self-motion, is superfluous or not.

Definition

L

The

The Reason of this Difficulty, perhaps, was this: Original Self-motion, Life *, and the Energy of Mind, being supposed the same (in his *Metaphysics*, he says, the Energy of Mind is Life), there was something in Mind prior to Number, which it was hard to speak out, so as to be understood. *Number* he defines himself to be *Multitude, measured by One*. But what would it signify to define *Mind* by *One*?—As the human Mind proceeds from that, which is less evident in itself, to that which is more so; the

* AS TO LIFE or LIVING, the most general universal Sense of it is, in Truth, MIND, or ACTUAL UNDERSTANDING; and so the Antients speak of LIFE ABSOLUTELY; it is NOÏΣ. To have an Idea of LIFE, in this Sense, lay aside all that passes in your Body, or in the sensible World, and consider yourself as actually viewing Things with your Mind—How silent, quiet, motionless, is all in this View! In our human Mind, there is no Motion, or Disturbance, but in its successive Views; and even these successive Views are gone in a MIND that is PERFECT.

Definition

Definition by Number was much more instructive.

* For Definitions are to be used, not as they are just and exact, but as they teach and instruct, and are adapted to the present Apprehensions of Men.

This Rule of Definition the Antients seem to have applied to Writing and Conversation at large; and by this *Aristotle* accounts for the † *fabulous Manner of the old Philosophers*, however shocking it may seem to modern Ears.

That there was any true Policy, or even Honesty, or any Sense of Religion, in these primitive Founders or Reformers, who introduced the Worship of Gods in the Form of Man, I dare say there are very few modern Philosophers will allow.---

* *Topic. p. 247.*

† What he says afterwards in Honour of Mankind, that all Arts and Philosophies had been often found out, and lost again, is very remarkable. *Met. p. 1003.*

Yet, it seems, it was otherwise with their Predecessors amongst the Antients. And we find *Socrates* himself, in his Discourse with *Aristodemus*, who neither offered Sacrifice, nor used Divination, but laught at those that did, pressing him by performing his Duty to the Gods to make Trial of them, whether they would not advise him in Things that were beyond the Reach of human Knowledge; and this as the Means of acquiring a more full and perfect Knowledge of the Divinity---For, as he had described it to him just before, by the Idea of a human Mind, joined with an enlarged, clear, and penetrating Sense of Particulars throughout the World, it was rather *Apollo* in the Center of the planetary System, than the Divinity itself.---But the UNIVERSE must be full of such DEITY in the strictest Sense, or you could not know the Divinity (to use

use his concluding Words) *to be such, and so great, that it should at once see all Things, and hear all Things, and be present every-where, and at once take care of all Things.*

This Definition of the Soul by *Number, and Self-Motion*, which, in his Book on the Soul, *Aristotle* seems to make the most nonsensical Thing, it is remarkable he has himself used in his *Physics*, where he finds Occasion to suggest, in his physical Way, something of the *Harmony of Mind with sensible Things*; or, if you please, ETERNITY with TIME, which he defines by Number in MOVING THINGS.

And, if *Plato* expresses himself more darkly, speaking of TIME as an IMITATION OF ETERNITY ABIDING IN ONE, it may be observed, this is after the Formation of the Soul, and not so improper, if that which is first in the Soul is ONE itself.

The **UNIVERSE** every Moment takes a different Form from that of the preceding and following Moment. The Perception of these particular Forms is called Sense, in Opposition to the **GENERAL IDEA**, which contains all these particular Forms. Can there be conceived any Imperfection in God's Eye, if it has always before it these different Objects?

SKETCH

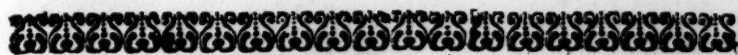
OF
UNIVERSAL ARITHMETIC

The Differential Calculus, and the
Differential Fluxions

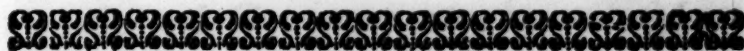
1850

The United States of America
do hereby certify that
the following is a true and correct
copy of the original
as the same appears on file
in the office of the
Secretary of the Interior
at Washington, D.C.

Witness my hand and seal
this 1st day of January 1850



A
S K E T C H
O F
UNIVERSAL ARITHMETIC,
Comprehending
The Differential *Calculus*, and the
Doctrine of FLUXIONS.



UNIVERSITY OF CHICAGO PRESS

A

SKETCH

OF

UNIVERSAL ARITHMETIC

Comprehending


The Differential Calculus, and the
Doctrine of Fluxions.

UNIVERSITY OF CHICAGO PRESS



A
S K E T C H
O F
UNIVERSAL ARITHMETIC.

S I R,

 O U have here a Sketch of those mathematical Principles, which I said were prior in Nature to the Method of Fluxions, the Differential Calculus, and Arithmetic of Infinites. Whether they are so, or not, you will now be a Judge; and how far, on this Bottom, Arithmetic and Geometry may be restored to their primitive Purity and Simplicity.

The Science of Mathematics having suffered much by a confused way of treating its principal Subjects, it cannot be deemed impertinent, before I proceed, to distinguish in what manner, and how far, I consider mathematical Quantity.

I do not then consider it as generated or produced, but as that which IS. Time and Motion produce nothing of the Kind, and have no Place here. Nor do I consider it as continuous, nor as consisting of very small or infinitely little Parts, but as consisting of Parts in general.

These Parts therefore I consider as discrete: And by $x, y, z, \&c.$ I understand Multitude. The Ones or Monads, of which x is many, I call x ; of which y is many y ; of which z is many z , $\&c.$

Nor do I consider $x, y, z, \&c.$ barely as many; but as a certain many. So that $x, y, z, \&c.$ are Wholes; $x, y, z, \&c.$ their respective Parts. These Parts may be considered again as Wholes, consisting of another Order of Parts; and these again as other Wholes, consisting of Parts of a third Order, $\&c.$

That which does not consist of Parts, nor is itself a Part, nor many, nor One of any many, has no Place in the Science of discrete Quantity; nor of continuous Quantity, as the latter is contained under the former. Continuous Multitude, such as that in Time, Space, and Motion, will indeed naturally fall under general Theorems of Arithmetic. But
such

such Things as an Instant, a Point, a Fluxion, she has nothing to do with. She can make nothing of them by any of her Operations. I have joined Fluxion with Point and Instant, because Fluxion seems to be to Motion, as an Instant is to Time; which I suppose to be as a Point is to a Line. Motion cannot be conceived without Time and Space; and when the former runs into an Instant, and the latter into a Point, then it is (as I understand it) that Motion becomes Fluxion. In this Sense only I exclude Fluxion from having any thing to do in Arithmetic: In this Sense Fluxion is no more a Part of Motion, than a Point is a Part of a Line. Nor does Fluxion consist of many Fluxions, any more than a Point consists of many Points. As Motion itself cannot be conceived without Time and Space; so many Motions, that is to say, a Variety of Motion, cannot be conceived without a Variety of Time or Space, or both. But however this Matter is understood, it concerns not Arithmetic itself, but only the Application of it.

As x , y , z , &c. are Wholes, so are their Products. Under Products I comprehend Powers,

Powers, and whatsoever is produced (if I may so say) by Division, as well as Multiplication.—To find the Part of any Product, the Rule is this which follows:

In any given Product, for x , y , z , &c. put $x+x$, $y+y$, $z+z$, &c. Then multiply these Quantities into one another, as $x+x$ by $y+y$, &c. and subtract the given Product from this new one, and the Remainder is the Part required.

EXAMPLES.

Let it be required to find the Part of the Product xy by the preceding Rule: For x put $x+x$, and for y , $y+y$; then multiply $x+x$ by $y+y$; and from that Product, which is $xy+xy+yx+xy$, subtract the given Product xy the Remainder is $xy+yx+xy$, for the Part required. The Part of x^3 is $3x^2x+gx^2+x^3=x+x^3-x^3$. The Part of xy^2 is $y^2x+2xyy+xy^2+2yyx+xy^2=x+x \times y+y^2-xy^2$. The Part of $x^4-2x^3x+x^2x^2$ is $\frac{2}{3}x^3=x+x^4-$

$$\frac{2 \times x + x^3 \times x}{6x} + \frac{x + x^2 \times x^2}{6x} - \frac{x^4 - 2x^3x + x^2x^2}{6x}$$

The

The Part of $\frac{x \times x - x}{x}$ is $\frac{2x \times x - x}{x} + \frac{x \times x - x \times x}{x}$
 $\frac{-x}{x}$. And the Part of $\frac{x \times x - x \times x - 2x}{x}$ is $\frac{3x}{x}$

$$\frac{x \times x \times x - x}{x} = \frac{x}{x} + \frac{x \times x \times x - x}{x} - \frac{x \times x \times x - x \times x - 2x}{x}$$

And the Part of $\frac{x \times x - x \times x - 2x \times x - 3x}{x}$
 $= \frac{4x \times x \times x - x \times x - 2x}{x} - \frac{x}{x} + \frac{x \times x \times x - x \times x - 2x}{x}$
 $- \frac{x \times x - x \times x - 2x \times x - 3x}{x}$, &c.

This is all evident at Sight, without confounding the Characters by actual Multiplication.

Because the Part of $\frac{x \times x - x}{x}$ is $\frac{2x \times x}{x}$,
 therefore x is the Part of $\frac{x \times x - x}{2x}$. And

for a like Reason $\frac{x \times x - x}{2x}$ is the Part of

$$\frac{x \times x - x \times x - 2x}{2x \times 3x} \text{ And so again } \frac{x \times x - x \times x - 2x}{2x \times 3x}$$

is the Part of $\frac{x \times x - x \times x - 2x \times x - 3x}{2x \times 3x \times 4x}$ &c.

For this Doctrine of Wholes and Parts proceeds upwards from Parts to Wholes, as well as downwards from Wholes to Parts uniyersally.

It

It is evident in these last Examples, where x is found in some Term or Terms of the Whole, that I have only consider'd it as a Part of x ; that is to say, as one, not as many or a Whole in itself, consisting of other Parts.

If you consider x as a Whole, and call its Parts or Monads x , then the Part of $x x$ is $x x + x^2 + x x = x + x x x + x - x x$. And the Part of $x^2 x - x^2 x$ is $x^2 x + 2 x x^2 + x^3 = x + x^2 x x + x - x + x^2 x x - x^2 x - x^2 x$.

Where again x is not consider'd as a Whole, but only as the Part of x . When x is consider'd as a Whole, its Part may be called x ; and so again the Part of x consider'd as a Whole x &c.

In like manner $y y y y$ &c. $z z z z$ &c. may stand each of them for Parts and Wholes to one another. And the Parts of any Products of those Quantities are given by this Rule; which I shall now proceed to set in as clear a Light as I can.

Expli-

Explication of the Rule for finding Parts.

TO have something then that may be called Knowledge of this Doctrine of Whole and Parts, as it falls under the Rule of which I have only hitherto given Examples, it will be necessary to observe—That the Number of Parts in every Product is always less by One than the Number of Parts in x, x, x &c. which make that Product;—That the Whole is sometimes equal to the Sum of its Parts given by the Rule, and sometimes not—And lastly, when this is the Case, it will be necessary to know what is to be thrown into the Balance to make the Scales even, if any thing be wanting on either Side; as likewise to know when nothing is wanting. All this I believe will be very plain from what follows.

Let $x = x' + x, x = x'' + x, x = x''' + x, x = x'''' + x, \&c.$

Likewise $y = y' + y, y = y'' + y, y = y''' + y, y = y'''' + y \&c.$

Then by the Rule

$$x y - x' y = x' y + y x + y x$$

$$x y - x'' y = x'' y + y x + y x$$

M

$x'' y$

$$x''y - x'y'' = x''y + y''x + yx''$$

$$x''y''' - x'''y'' = x''y''' + y''x''' + y'''x'' \&c.$$

If you stop proceeding here, supposing x when it becomes x to be x and y when it becomes y to be y ; then S: $\overline{xy + yx + xy}$ (standing for the Sum of the Parts) will be equal to $x^4y - x^3y^2 + x^2y^3 - x^4y + x^3y^2 - x^2y^3 + x^4y - x^3y^2 + x^2y^3 - x^4y + x^3y^2 - x^2y^3$. And whereas the Number of Parts of xy is Four, it is plain the Number of Parts in its Factors x and y is Five. And it is evident, stop wherever you please, the Number of Parts given by the Rule will be for ever less by one than the Number of Parts in x and y . Here likewise it is evident, that if you stop anywhere in the Progression, xy is never the adequate Sum of its Parts, but always bigger by xy . And this indeed may be sufficient to shew how in this Case, the Matter stands universally. However, I shall add one Example more of this Case.

$$2. \quad 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$$

By

By the Rule, then, as before,

$$x^n - \dot{x}^n = nx^{n-1}x + n \times \frac{n-1}{2} x^{n-2}x^2 \&c.$$

$$\dot{x}^n - \ddot{x}^n = n\ddot{x}^{n-1}x + n \times \frac{n-1}{2} \ddot{x}^{n-2}x^2 \&c.$$

$$\ddot{x}^n - \overset{'''}{x}^n = n\overset{'''}{x}^{n-1}x + n \times \frac{n-1}{2} \overset{'''}{x}^{n-2}x^2 \&c.$$

$$\overset{'''}{x}^n - \overset{''''}{x}^n = n\overset{''''}{x}^{n-1}x + n \times \frac{n-1}{2} \overset{''''}{x}^{n-2}x^2 \&c.$$

If, as before, you stop any where in the Progression; for Example, when x is become $\overset{'''}{x} = x$, then calling the Sum of the Parts S : $n x^{n-1}x + n \times \frac{n-1}{2} x^{n-2}x^2 \&c.$

$$x^n = \overset{'''}{x}^n + S: n x^{n-1}x + n \times \frac{n-1}{2} x^{n-2}x^2 \&c.$$

By these two Examples, I suppose, it will appear, that the Number of Parts of any single Product whatever, is always less by One than the Number of Parts in $x, y, z, x, y, z \&c.$ That the Sum of the Parts is never equal to the Whole, and what is to be added to make them so. For Example, it is evident, that $x^2 y^2 = x^2 y^2 +$
M 2 S:

S: $y^2 x + 2xy y + xy^2 + 2yyx + y^2 x$,
stop wherever you will in the Series. This
is One Case.

Another is, when you suppose the Series
to continue; and that as the Difference of
the Products, which makes the Terms of
it, continually lessens, you suppose it at last
to be nothing.

In this Case every single Product will be
the accurate Whole and just Sum of its
Parts, as obtained by the Rule. For Ex-
ample, $x^n = S: \frac{nx^{n-1}x + n \times n-1 x^{n-2}x^2}{2} \&c.$

Call the Terms in which are $x^2, x^3 \&c.$ T,
then $x^n - T = S: x^{n-1}x$.

What has been said before of Wholes
consisting of a single Product, holds uni-
versally in all Wholes consisting of many
Products, when every Factor of every one of
these Products is consider'd as a Whole. There
is another Case of Wholes, consisting of many
Products; in which some of the Factors are
only Parts, of which I shall give an Exam-
ple or two: But by the way it may be no-
ted, that when as in the former Case x, y, z
&c. $x, y, z \&c.$ are only consider'd as Parts
in

in general: In this Case they are always equal to themselves, or if you please, invariable.

By the Rule for finding Parts,

$$\frac{x^3}{3} - \frac{x^2x}{2} + \frac{xx^2}{6} - \frac{\dot{x}^3}{3} - \frac{\dot{x}^2\dot{x}}{2} + \frac{\dot{x}\dot{x}^2}{6} = \dot{x}^2\dot{x}$$

$$\frac{\dot{x}^3}{3} - \frac{\dot{x}^2\dot{x}}{2} + \frac{\dot{x}\dot{x}^2}{6} - \frac{''x^3}{3} - \frac{''x^2''x}{2} + \frac{''x''x^2}{6} = ''x^2''x$$

$$\frac{''x^3}{3} - \frac{''x^2''x}{2} + \frac{''x''x^2}{6} - \frac{'''x^3}{3} - \frac{'''x^2'''x}{2} + \frac{'''x'''x^2}{6} = '''x^2'''x$$

$$\frac{'''x^3}{3} - \frac{'''x^2'''x}{2} + \frac{'''x'''x^2}{6} - \frac{''''x^3}{3} - \frac{''''x^2''''x}{2} + \frac{''''x''''x^2}{6} = ''''x^2''''x$$

&c.

Here whether you stop or proceed; whether you suppose the Number of Parts within the Compass of x to be finite or infinite, the Whole, *viz.* $\frac{x^3}{3} - \frac{x^2x}{2} + \frac{xx^2}{6}$ is

always equal to $S: x^2x$, because whenever it is that x becomes \dot{x} , the last Subtrahend, *viz.* $\frac{x^3}{3} - \frac{x^2x}{2} + \frac{x^3}{6}$, which you have by

putting \dot{x} for x in the given Whole, will be always Nothing. In like Manner the Part of $\frac{2x^3 + 3x^2x - 5xx^2}{6x}$ is $\overline{x + \dot{x}^2}$, and

$2x^3$

$$\frac{2x^3 + 3x^2x + xx^2}{6x} = S: \overline{x+x}^2 \text{ accurately;}$$

$$\text{whereas } \frac{2x^3 + 3x^2x + x^2}{6x}, \text{ whose Part is}$$

likewise $\overline{x+x}^2$, is equal to $x^2 + S: \overline{x+x}^2$.
I shall add but one Example more, which is this:

By the same general Rule;

$$\frac{xx - x\dot{x} - \dot{x}\dot{x} - \dot{x}\ddot{x}}{xx - x\dot{x} - \dot{x}\dot{x} - \dot{x}\ddot{x}} = \frac{\dot{x}\dot{x} + \dot{x}\ddot{x}}{xx - x\dot{x} - \dot{x}\dot{x} - \dot{x}\ddot{x}}$$

$$\frac{\dot{x}\dot{x} - \dot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x}}{\dot{x}\dot{x} - \dot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x}} = \frac{\ddot{x}\ddot{x} + \ddot{x}\ddot{x}}{\dot{x}\dot{x} - \dot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x}}$$

$$\frac{\ddot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x}}{\ddot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x}} = \frac{\ddot{x}\ddot{x} + \ddot{x}\ddot{x}}{\ddot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x} - \ddot{x}\ddot{x}}$$

&c.

Here again it is plain, whether you stop or proceed, $\frac{xx - x\dot{x} - \dot{x}\dot{x} - \dot{x}\ddot{x}}{xx - x\dot{x} - \dot{x}\dot{x} - \dot{x}\ddot{x}} = S: \frac{\dot{x}\dot{x} + \dot{x}\ddot{x}}{xx - x\dot{x} - \dot{x}\dot{x} - \dot{x}\ddot{x}}$; Because when x becomes \dot{x} , and \dot{x} becomes \ddot{x} , $xx - x\dot{x}$ becomes $\dot{x}\dot{x} - \dot{x}\ddot{x} = 0$.

And $xx - x\dot{x}$ is twice the Sum of an Arithmetical Progression, whose Difference is \dot{x} , whether the Number of Terms be finite, or infinite.

From what has been said, the General Rule for discovering whether any thing be wanting, and what it is to make any given Whole equal to its Parts, will be plain. It is this;

In every given Whole, for $x, x, x \&c.$
 $y, y, y \&c.$ $z, z, z \&c.$ put $x, x, x \&c.$
 $y, y, y \&c.$ $z, z, z \&c.$, and take the
 Sum of the Terms. If it be nothing; no-
 thing is to be added; If something Affir-
 mative, it must be subtracted; if something
 Negative, it must be added to the given
 Whole.

I have nothing farther, I think, to add
 in Explication of the General Rule for find-
 ing the Parts of given Wholes; and there-
 fore I shall proceed to turn the Subject the
 other way, and consider the Question, How
 to find Wholes from given Parts.

This Question, I think, can only be an-
 swered, except it be casually in particular
 Cases, by proceeding analytically on the
 Bottom of the General Rule for finding the
 Part of a given Whole.

As a plain Example or two perhaps may
 give a fuller Idea of this Analysis than ge-
 neral Theorems, I shall begin with the
 lowest. Suppose then I were to find the
 respective Wholes of the Parts, $xx + x^2$,
 $xx, x, x + x$. For the Whole sought in
 either Case, I assume $ax^2 + bx$. I find the
 Part of it according to the Rule; and by
 putting

putting the Parts proposed equal to it, I determine a and b ; and so find their respective Wholes.

To begin with the first, *viz.* The Part of $ax^2 + bx$ is $2axx + ax^2 + bx$ } and $xx + x^2$. If $2axx = xx$, and $ax^2 + bx = x^2$, then $a = \frac{1}{2}$, and $b = \frac{x}{2}$; the Whole sought therefore is

$$\frac{1}{2}x^2 + \frac{1}{2}xx.$$

For the Whole of xx I put $xx = 2axx$, and $ax^2 + bx = 0$; and then comes out $a = \frac{1}{2}$ and $b = -\frac{x}{2}$, and consequently $ax^2 + bx = \frac{x^2}{2} - \frac{xx}{2}$. In like manner for the Whole

of which x is a Part, I put $x = 2axx$, and $ax^2 + bx = 0$, then $a = \frac{1}{2x}$ and $b = -\frac{1}{2}$, and $ax^2 + bx = \frac{x^2}{2x} - \frac{x}{2}$.

To come to the last Instance $x + x$: Here I put $x = 2axx$, and $x = ax^2 + bx$; whence $a = \frac{1}{2x}$, and $b = \frac{1}{2}$, and $ax^2 + bx = \frac{x^2}{2x} + \frac{x}{2} = \frac{x^2 + xx}{2}$, which agrees with what was determined before for the Whole of $xx + x^2$. For if $\frac{x^2 + xx}{2}$ is the Whole

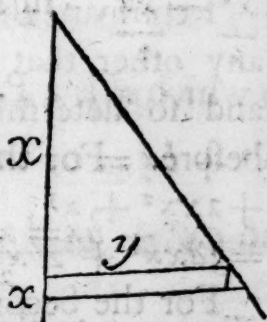
of

of $x \times + x^2$, the Consequence is, that $\frac{x^2 + x \times}{2x}$ is the Whole of $x + x$.

Had I been to find the Whole whose Part is $x \times^2 + \frac{x^3}{3}$, I should have assumed

$ax^2 \times + bx \times$, the Part of which is $\frac{2ax \times^2 + a \times^3}{3} + b \times^2$ then putting $x \times^2 = 2ax \times^2$, and $\frac{x^3}{3} = a \times^3 + b \times^2$; $a = \frac{1}{2}$, and $b = -\frac{x}{6}$, and $ax^2 \times + bx \times = \frac{x^2 \times}{2} - \frac{x \times^2}{6}$.

The Equation to the Triangle is $ax=y$: The Rectangle in the Triangle $ax \times = y \times$; the Sum of them by x what was just now determined $a \times \frac{x^2}{2} - \frac{x \times}{2}$, and



will for ever be so, whilst x has any Being.

The less x is, the nearer indeed $\frac{a \times x^2}{2} - \frac{x \times}{2}$

is to an Equality with the Area, but not the Area, till the Parallels come together, and $x=0$; and then $\frac{a \times x^2}{2} - \frac{x \times}{2} = \frac{a \times x^2}{2}$. I

have added this plain Example, to shew how I understand the whole Business of the Quadrature

drature of Curves to proceed on these Principles.

To proceed one Step farther ;

To find the respective Wholes, of which

$$\overline{x^2x + 2xx^2 + x^3}, \overline{x^2 + 2xx + x^2}, \overline{x^2 - xx},$$

(which was just now a Whole) x^2x , x^2 , x^2+x are Parts. For the Whole sought I assume $ax^3 + bx^2 + cx$; and with the Parts of it, viz.

$$\begin{aligned} 3ax^2x + 3axx^2 + ax^3 \\ 2bxx + bx^2 \\ + cx \end{aligned}$$

I compare the given Parts mentioned, or any other that may be compared with it, and so determine the Value of a , b , c , as before. For the first Example, viz. $x^2x + 2xx^2 + x^3$, I put $x^2x = 3ax^2x$, $2xx^2 = 3axx^2 + 2bxx$, $x^3 = ax^3 + bx^2 + cx$.

For the Second, viz. $x^2 + 2xx + x^2$, $x^2 = 3ax^2x$, $2xx = 3axx^2 + 2bxx$, $x^2 = ax^3 + bx^2 + cx$.

For the Third, $\overline{x^2 - xx}$, $x^2 = 3ax^2x$, —
 $-xx = 3axx^2 + 2bxx$, and $ax^3 + bx^2 + cx = 0$; laying aside the Divisor 2, till the Whole is determined, and then dividing it by 2.

For the Fourth, viz. x^2 , I put $x^2 = 3ax^2x$, $3axx^2 + 2bxx = 0$, and $ax^3 + bx^2 + cx = 0$.

For the Fifth, viz. x^2 , in like Manner, $x^2 = 3ax^2x$, $3axx^2 + 2bxx = 0$, and $ax^3 + bx^2 + cx = 0$.

For the last, viz. $x^2 + x$, I put $x^2 = 3ax^2x$, and $x = 3axx + 2bxx$, and $ax^3 + bx^2 + cx = 0$.

There is one Example more, which I shall mention; it is, $2x^2x + xx^2$, the Rectangle in the common Parabola.

Let $2x^2x = 3ax^2x$, $xx^2 = 3axx^2 + 2bxx$ and $ax^3 + bx^2 + cx = 0$; then $a = \frac{2}{3}$, $b = -\frac{x}{2}$, $c = -\frac{x^2}{6}$. The Sum of the Triangles is $\frac{2x^3}{3} - \frac{x^2x}{2} - \frac{xx^2}{6}$; and the Area $\frac{2}{3} x^3$.

If I wanted only the Area, it would be sufficient to assume only $2x^2x$, neglecting the other Term xx^2 ; then $2x^2x = 3ax^2x$, $3axx^2 + 2bxx = 0$, and $ax^3 + bx^2 + cx = 0$. Hence $a = \frac{2}{3}$, $b = -x$, $c = \frac{x^2}{3}$, and the

Sum of these lesser Rectangles $\frac{2}{3} x^3 - xx + \frac{xx^2}{3}$, and when $x = 0$, the Area $\frac{2}{3} x^3$.

To

To find the Whole, whose Part is

$$ax^{m-1}x + bx^{m-2}x^2 + cx^{m-3}x^3 + dx^{m-4}x^4, \&c.$$

I proceed on this Bottom, by assuming $Ax^m + Bx^{m-1} + Cx^{m-2} + Dx^{m-3}, \&c.$ for the Whole sought.

To

Let

$$\text{Let } \overline{Ax+x}^m = Ax^m + m Ax^{m-1}x + \frac{m \times m-1}{2} Ax^{m-2}x^2 + \frac{m \times m-1 \times m-2}{6} Ax^{m-3}x^3 + \dots$$

$$\overline{Bx+x}^{m-1} = Bx^{m-1} + m-1 Bx^{m-2}x + \frac{m-1 \times m-2}{2} Bx^{m-3}x^2 + \dots$$

$$\overline{Cx+x}^{m-2} = Cx^{m-2} + m-2 Cx^{m-3}x + \dots$$

$$\overline{Dx+x}^{m-3} =$$

$$\overline{Ex+x}^{m-4} =$$

&c.

Subtract, according to the Rule for finding Parts, the assumed Whole, and put the Remainder, which is its Part equal to the given Part whose Whole is sought; and then the Coefficients $A, B, C, D, \&c.$ will be determined. For if $m Ax^{m-1}x = ax^{m-1}x$, and $\frac{m \times m-1}{2} Ax^{m-2}x^2 + \frac{m-1}{1} Bx^{m-2}x = \frac{bx^{m-2}x^2}{2}$, and $\frac{m \times m-1 \times m-2}{6} Ax^{m-3}x^3 + \frac{m-1 \times m-2}{2} Bx^{m-3}x^2 + m-2 Cx^{m-3}x = \frac{cx^{m-3}x^3}{2}$, and $\frac{m \times m-1 \times m-2 \times m-3}{24} Ax^{m-4}x^4 + \frac{m-1 \times m-2 \times m-3}{6} Bx^{m-4}x^3 +$

$$\frac{m-1 \times m-2}{2 \times 3} A x^{m-3} x^3 + \frac{m \times m-1 \times m-2 \times m-3}{2 \times 3 \times 4} A x^{m-4} x^4, \&c.$$

$$\frac{m-2}{2} B x^{m-3} x^2 + \frac{m-1 \times m-2 \times m-3}{2 \times 3} B x^{m-4} x^3, \&c.$$

$$-2 C x^{m-3} x + \frac{m-2 \times m-3}{2} C x^{m-4} x^2, \&c.$$

$$D x^{m-3} + m-3 D x^{m-4} x, \&c.$$

$$E x^{m-4}, \&c.$$

$$+ \frac{m-2 \times m-3}{2} C x^{m-4} x^2 + \frac{m-3}{2} D x^{m-4} x =$$

$$= d x^{m-4} x^4, \&c. \text{ Then } A = \frac{a}{m}, B =$$

$$= b x - \frac{m \times m-1}{2} A x \times \frac{1}{m-1}, C = c x^2 -$$

$$\frac{m \times m-1 \times m-2}{2 \times 3} A x^2 - \frac{m-1 \times m-2}{2 \times 3} B x \times$$

$$\times \frac{1}{m-2}, D = d x^3 - \frac{m \times m-1 \times m-2 \times m-3}{2 \times 3 \times 4}$$

$$A x^3 - \frac{m-1 \times m-2 \times m-3}{2 \times 3} B x^2 -$$

$$\frac{m-2 \times m-3}{2} C x \times \frac{1}{m-3}, \&c. \text{ The Whole}$$

$$\text{therefore, of which } a x^{m-1} x + b x^{m-1} x^2 + \\ + c x$$

+ $cx^{m-3}x^3$, &c. is a Part, is $\frac{a \times x^m}{m} +$

$$\frac{bx^{m-2}x^2 - \frac{m \times m - 1}{2} Ax \times x^{m-1} + \frac{cx^2 - \frac{m \times m - 1 \times}{2} \times m - 2}{m-1} Ax^2 - \frac{m-1}{2} \times m - 2 Bx \times x^{m-2}, \&c.$$

If you suppose $b=0=c=d=e$, &c. then this Whole will become the Whole, whose Part is $ax^{m-1}x$. And the Whole in this Case reduced, will become, $\frac{ax^m}{m} - \frac{ax^{m-1}}{2} + \frac{m-1}{3 \times 4}$

$$\frac{ax^{m-2}x^2 - \frac{m-1 \times m - 2 \times m - 3}{2 \times 3 \times 4 \times 5 \times 6} ax^{m-4}x^4 + \frac{m-1 \times m - 2 \times m - 3 \times m - 4 \times m - 5}{2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8} ax^{m-6}x^6.$$

And this Theorem may be sufficient, as a Principle to the inverse Method of Fluxions and differential Calculus; and particularly in the Case of the Quadrature of Curves, whose Abscissa is x , and Ordinate one or many Products of x . For that which is here given is a Rectangle under a Part of the Abscissa into the Ordinate; and indeed nothing else. However this Matter has been refined upon, it comes after all at last to this, or vanishes into Air.

This Theorem may likewise serve to exhibit particular Theorems, for determining

N

any

any given Number of Rectangles under Ordinates and equal Parts of Abscissa's or of Cylinders; or of Tangents to Curves. And the Length of Curve Lines, the Areas of the Curves, and their solid Content, will be particular Cases of these which I have called particular Theorems.

With regard to the direct Method of proceeding by way of Fluxions or Infinites, it is evident by what has been said in the Beginning, That the Increments of the Terms of Equations are universally the Parts of those Terms; and likewise that the said Terms are the adequate Wholes of those Parts. Thus the direct as well as the inverse Methods will appear under these Principles in their natural Light. It is but to interpret rightly the received Notation, and the whole Affair will proceed as it now stands.

Put the Part or Increment of any Term equal to that which is commonly called its Fluxion, and this will give the true Meaning of \dot{x} , \dot{y} , \dot{z} , &c.

For Example; If $dx - 2xx\dot{x} = dx - 2xx\dot{x}$, then $\dot{x} = \frac{dx}{2x}$. And in this Sense of \dot{x} , $dx - 2xx\dot{x}$ is the Part of $dx - x^2$. And so

so if $2y\dot{y} = 2y\dot{y} + \dot{y}^2$, and $\dot{y} = y + \frac{\dot{y}^2}{2y}$, then $2y\dot{y}$ is the Part of y^2 . And so again, if $\dot{y} = y + \frac{\dot{y}^2}{2y} + \frac{\dot{y}^3}{3y^2}$, $3y^2\dot{y}$ is the Part of y^3 . As for the Part of $x\dot{y}$, it is $\dot{x}y + y\dot{x}$, supposing $x\dot{y} + y\dot{x} + y\dot{x} = \dot{x}y + y\dot{x}$ and $\dot{y} = y + \frac{y\dot{x}}{x}$.

And if you suppose $a\dot{x} - 2y\dot{y}$ to stand not only for $\frac{a\dot{x} - 2y\dot{y} - \dot{y}^2}{2\sqrt{ax - y^2}}$, but for this and all other subsequent Terms exhibited in the Binomial Theorem, then $\frac{a\dot{x} - 2y\dot{y}}{2\sqrt{ax - y^2}}$ will be the Part of $\sqrt{ax - y^2}^{\frac{1}{2}}$ the first Term.

And thus by giving a like Meaning to the received Notation throughout to \ddot{x} , \ddot{y} , \ddot{z} , &c. as well as to \dot{x} , \dot{y} , \dot{z} , &c. our Equations will be always Mathematically true.

As for rejecting Terms out of Equations, as having no Concern in them, on the Account of their being infinitely little; this is what the accurate Genius of the Prince of Mathematicians could not away with. It was this which seems to have set him on the Invention of a Method intirely new to the Mathematical World, the Method of

Fluxions. It will be a pardonable Ambition, if I endeavour to demonstrate, that I have so great an Authority on my Side, with regard to this Sense I have presumed to put upon the received Notation. I shall proceed on the Bottom of his Demonstration of the Rule of Fluxions, as it stands for the Foundation of his Doctrine of Quadratures.

The Demonstration then proceeds thus.

$\dot{z}o$ and $\dot{y}o$ being supposed the Increments of z and y , that is $\dot{z}o = \dot{z}$ and $\dot{y}o = \dot{y}$, the Increments of the Equation $z = ay^3$ are $\dot{z}o = 3ay^2\dot{y}o + 3ay\dot{y}o^2 + a\dot{y}o^3$, and dividing by o , $\dot{z} = 3ay^2\dot{y} + 3ay\dot{y}^2o + a\dot{y}^3o^2$. Let the Quantity o be diminished infinitely; then, the vanishing Terms neglected $\dot{z} = 3ay^2\dot{y}$. Such is the Demonstration of the Rule of Fluxions. And on the Bottom of this I presume to advance another, as follows.

Since $\dot{z}o = \dot{z}$, and $\dot{y}o = \dot{y}$; $\dot{z} = \frac{\dot{z}}{o}$ and $\dot{y} = \frac{\dot{y}}{o}$; if $\dot{z} = 3ay^2\dot{y}$, $\frac{\dot{z}}{o} = 3ay^2\frac{\dot{y}}{o}$; and consequently $\dot{z} = 3ay^2\dot{y}$; but $\dot{z} = 3ay^2\dot{y} + 3ay\dot{y}^2 + a\dot{y}^3$; therefore $3ay\dot{y}^2 + a\dot{y}^3 = 0$; which will be acknowledged to be as contrary to the Meaning of the Author, as it is in itself absurd.

absurd. This would be rejecting finite Quantities instead of infinitely Littles as nothing. z therefore being supposed equal to $3ay^2j$; z or j must of Necessity change their Value as the other Terms go off; so that if j remains the same, z must decrease: If z be supposed to flow uniformly, and z remain the same, j must on the other hand increase. Let this be the latter Case, then $\frac{z}{0} = \frac{z}{0} = 3ay^2j = \frac{3ay^2j + 3ayj^2 + j^3}{0}$, which is coincident with the Sense before put upon j . And the Case will be the same, if, supposing z to flow uniformly, you put it equal to any flowing Quantity whatever, and reason after the same manner upon this Supposition; for this Way of Reasoning will reach as far as the Demonstration on which it is grounded, which, I suppose, is as far as the Rule of Fluxions reaches.

If you suppose $x^{m-1} \dot{x}$ to stand for the Motion by which the Parts of a Curve's Area are generated in equal Times, and call the Time 1; then will $x^{m-1} \dot{x} = x^{m-1} \dot{x} + \frac{m-1}{2} x^{m-2} \dot{x}^2 + \frac{m-1}{2} \times \frac{m-2}{3} x^{m-3} \dot{x}^3, \&c.$

For on Supposition that $\frac{x^m}{m}$ is the Area, the

Part of it is this very Thing, viz. $x^{m-1}x +$
 $+ \frac{m-1}{2} x^{m-2}x^2, \&c.$ and consequently
 $x^{m-1}x + \frac{m-1}{2} x^{m-2}x^2, \&c. = x^{m-1}x.$

But after all it may be objected, that I incumber the Science, by taking so many Things into the Account, which have often nothing to do with it, neither in the Direct, nor Inverse Method of Fluxions. To which I answer freely, that I have less Concern for *these Methods*, than I have for the SCIENCE ITSELF, which is of a much larger Extent, and in itself as different from them, as a TRIANGLE is from a *Triangular Field*.

As for the Direct Method of Fluxions, no Quantities are there rejected, as I understand it, but what Nature herself marks out, and, as the Case requires, dismisses.

As to the Inverse Method, there I own the Case is different, and here Quantities are rejected for Conveniency. But then it is always known, that the Whole in the Case of Fluents is as well obtained without them as with them. For Example, by the Theorem which finds the Whole of a given Part, it appears perfectly indifferent, whether I assume

sume $x^3x + x^2x^2 + x^3$ for finding the Whole in the Case of Fluents, or x^3x ; and for the same Reason, whether I assume

$$\sqrt{x^2 + x^3x + x^2x + x^3}^2, \text{ or only}$$

$$\sqrt{x^2 + x^3x}^2, \text{ \&c.}$$

The Theorem which is a Case of the General one that determines the Whole from the Part given, may, as I said above, serve as a Principle to the Quadrature of Curves, from a given Rectangle under a Part of the Abscissa x , and the Ordinate, when it consists of one or many Products of x . This Principle, for Example, will give the Area of the Curve, whose Ordinate is $max + m + n$
 $bxx + m + 2ncx^2x + m + 3ndx^3x$ into x^{m-1}
 $\times a + bx + cx^2 + dx^3$, &c. when this Algebraical Form is reduced. But it will not demonstrate $x^m \times a + bx + cx^2 + dx^3$, &c. to be the Area. This must be done on the general Principle of Whole and Part, as it takes Place here.

I take it for granted, that xy is equal to $S: xy + yx + yx$ in the Sense I have explain'd it, and which naturally does take Place here.

Let

Let $z = x^m$ and $y = a + bx + cx^2$, &c.
then $z = mx^{m-1}x + m \times \frac{m-1}{2} x^{m-1}x^2$, &c.

and $y = n \times a + bx + cx^2 + dx^3$, &c.
 $\times bx + 2cxx + cx^2 + 3dx^2x + 3dxx^2 + dx^3$, &c.
 $+ n \times \frac{n-1}{2} a + bx + cx^2$, &c. $\times bx +$
 $+ 2cxx + x^2 + 3dx^2x + 3dxx^2 + dx^3$,
&c.

Substitute these Values of z, y, z, y in
the Equation; and for the Sum of the Terms
in which x^2 and any higher Power of x is
found, put T . Then $x^m \times a + bx + cx^2$, &c.
 $= S: mx^{m-1}x \times a + bx + cx^2 + dx^3$, &c. $+$
 $+ n \times a + bx + cx^2 + dx^3$ $\times bx + 2cxx +$
 $+ 3dx^2x \times x^m + T$. And therefore since
 $mx^{m-1}x \times a + bx + cx^2$, &c. $+ n \times a + bx +$
 $+ cx^2$, &c. $\times bx + 2cxx$, &c. $\times x^m$ is the
same with $mx \times a + bx + cx^2$, &c. $+ nx \times$
 $\times bx + 2cxx + 3dx^2x$, &c. into $x^{m-1}x$
 $\times a + bx + cx^2$; $x^m \times a + bx + cx^2$, &c.
 $- T = max + m + nbxx + m + 2ncx^2x +$
 $+ m + 3ndx^3x$, &c. into $x^{m-1}x \times a + bx +$
 $+ cx^2$.

$\overline{+cx^2 + dx^3, \&c.}^{n-1}$. And consequently $\overline{x^m \times a + bx + cx^2, \&c.}^n$ when x becomes nothing, is the Area of the Curve, whose Rectangle is this given one.

Were the Area of the Curve $\overline{x^m \times a + bx + cx^2, \&c.}^n \times \overline{e + fx + gx^2, \&c.}^p$ its Rectangle is determined in the same Manner. 'Tis but to take before one the Equation

$$\begin{array}{c} zy\omega \quad z\gamma\omega \\ zy\omega = zy\omega + \omega yz + z\gamma\omega, \text{ put } z = x^m, \\ \omega zy \quad \omega zy \end{array}$$

$\overline{y = a + bx + cx^2, \&c.}^n \omega = \overline{e + fx + gx^2, \&c.}^p$; I find z, γ, ω , substitute, and for the Terms in which are found x^2 and higher Powers of x (and which in this Case are as obviously separated from the rest as in the former), put T , and the Business is done just as before; the Part coming out of which $\overline{x^m \times a + bx + cx^2, \&c.}^n \times \overline{e + fx + gx^2, \&c.}^p - T$ is the Whole, according to the fourth Proposition of Sir *Isaac's* Quadratures. 'Tis but to multiply his Ordinate by x , and give x a general Index instead

stead of Unit, and it will be the Thing itself.

The Way I take of assuming indeterminate Wholes, in order to obtain the exact determinate Ones of given Parts, may seem in some Cases at least, to be loose and uncertain. When therefore I have got out a Whole this way which I have any Suspicion of, I find its Part by the Rule for that Purpose; and if the Part so found be the same with the given One, I then conclude the Whole to be the true One. For Example, I suspect this odd Thing, viz. $\frac{x^3}{3x} + \frac{1}{2x} - \frac{xx^2}{2}$

$$+ \frac{x-3x}{6} = \frac{x^3}{2x} + \frac{x^2}{2x} - \frac{x^2}{2} + \frac{xx}{6} - \frac{x}{2},$$

which in this way of working comes out as the Part of which x^2+x is the Whole. I therefore take its Part from the Rule, thus;

$$\frac{x+x^3}{3x} = \frac{x^3}{3x} + \frac{x^2}{3x} + \frac{xx}{3} + \frac{x^2}{3}$$

$$\frac{x+x}{2x} = \frac{x^2}{2x} + \frac{x}{2x} + \frac{x}{2}$$

$$-\frac{x+x^2}{2} = -\frac{x^2}{2} - \frac{xx}{2} - \frac{x^2}{2}$$

$$x+x$$

$$\frac{x + x \times x}{6} = \frac{xx}{6} + \frac{x^2}{6}$$

$$-\frac{x + x}{2} = -\frac{x}{2} - \frac{x}{2}$$

Subtract the given Whole, and add the remaining Terms for the Part, and finding the Sum to make the Part sought, viz. $x^2 + x$, I conclude the Whole to be the true One. This way of Proof is allowed as the last Resource in the Case of Fluents. [See the last Words of the Tract of Quadratures.]

With what I have said of Fluxion in general, may be compared Sir *Isaac's* last Velocity in the last Scholium of the First Section of Book the First of his *Principia*, together with what he says in the Beginning of his Introduction to his Doctrine of Quadratures of the Fluxion of a Curve's Area, viz. That it is to the Fluxion of a Rectangle as its Ordinate to the Side of the said Rectangle; that is to say, It is a Velocity, not before, nor after, but then, when Two Ordinates meet. The Ordinate therefore being x^m , when $x^m \dot{x}$ expresses the Fluxion of it, the only Meaning I have for \dot{x} is, that it is the Proportion of a Point to an Instant. And to my Apprehension, a Point may

may as well be called a last Line, as this called a last Velocity.

It may not be amiss to observe, that the preceding SKETCH was written before the Dispute arose about the Doctrine of Fluxions. What follows, was occasioned by that Dispute, and therefore here annexed.

OUR



OUR Mathematicians of the first Rank are far from agreeing in their Sentiments of Sir *Isaac Newton's* Method of Fluxions. Mr. *Brooke Taylor* tells you, that Sir *Isaac* is more accurate and exact than all the Mathematicians that went before him. Mr. *Mac Laurin* is proud of demonstrating Sir *Isaac's* Doctrine on the Principles of the Antients.—What follows is very obvious.

A X I O M I.

There is Quantity bigger than any assignable One.—Let a be as big as you please, $a + b$ is bigger ; hence there is a Quantity less than any assignable One. Let $\frac{c}{a}$ be as little as you please, $\frac{c}{a + b}$ is less, and as much less as you please : For b may be any finite Quantity.

AXIOM

A X I O M II.

Let x be variable, the Ratio of Ax to Bx is always the same, whether x be any finite Quantity; or less than any such; that is, $A : B :: Ax : Bx$ in both those Cases, or in any other, supposing x to be always of the same Value in Ax as it is in Bx . — This Sir *Isaac* chuses to explain by Motion.

P R O P O S I T I O N.

If $ax + bx^2 + cx^3 + dx^4, \&c. = ex + fx^2 + gx^3 + hx^4 \&c.$ and if this be true, both when x is any finite Quantity, and when 'tis less than any such, then is $a = e, b = f, c = g, d = h, \&c.$

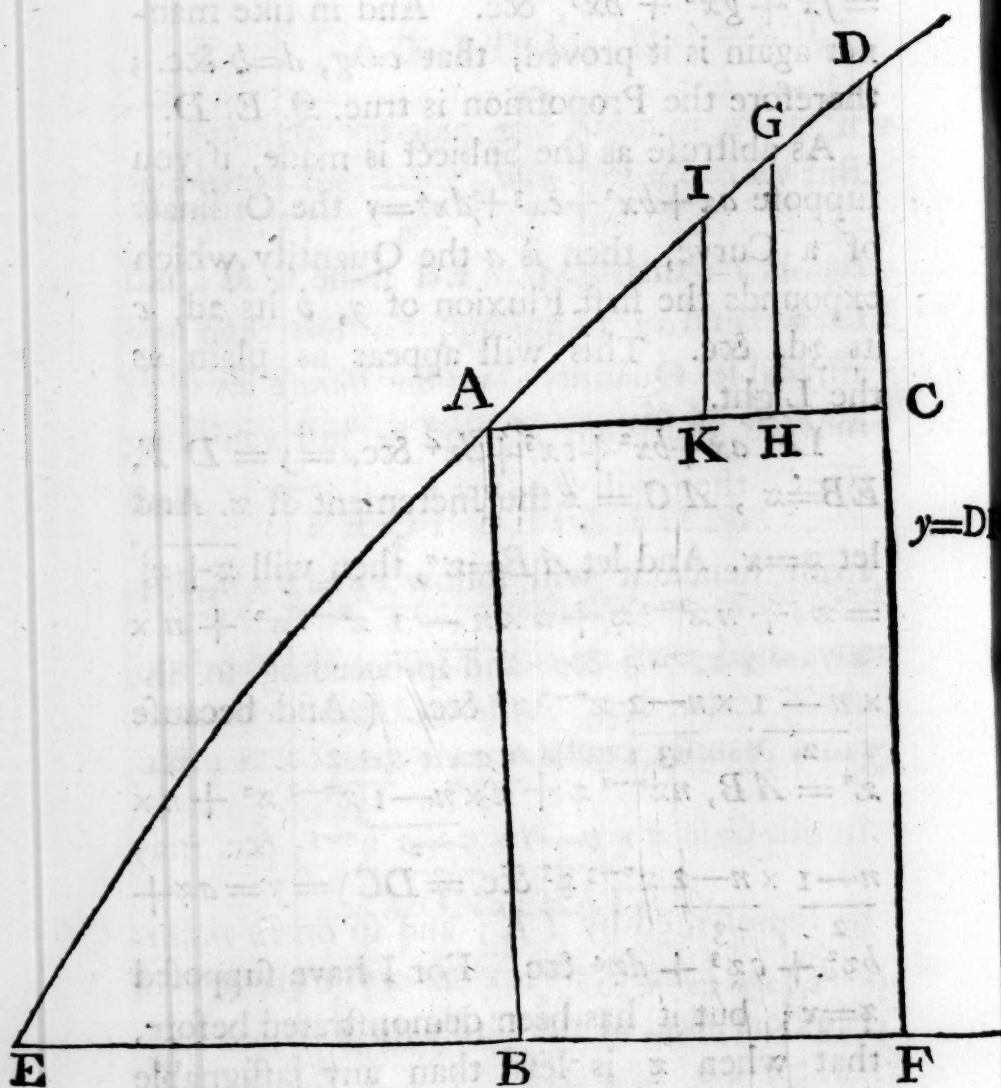
D E M O N S T R A T I O N.

If $ax + bx^2 + cx^3, \&c. = ex + fx^2 + gx^3 \&c.$ in both Cases, then must $a + bx + cx^2, \&c. = e + fx + gx^2, \&c.$ likewise in both Cases. (If you will not allow this, Sir *Isaac Newton* can do nothing.) Let x be less than any finite Quantity, then will $a = e$. In like manner is it proved, that $b = f$ &c. : For if $a = e$, then $bx + cx^2 + dx^3, \&c. = fx$

$=fx + gx^2 + bx^3$, &c. And in like manner again is it proved, that $c=g$, $d=b$ &c. ; therefore the Proposition is true. Q. E. D.

As abstruse as the Subject is made, if you suppose $ax + bx^2 + cx^3 + dx^4 = y$ the Ordinate of a Curve, then is a the Quantity which expounds the first Fluxion of y , b its 2d, c its 3d, &c. This will appear as plain as the Light.

Let $ax + bx^2 + cx^3 + dx^4$ &c. $= y = D F$,
 $EB = z$, $AC = z$ the Increment of z . And
let $z = x$. And let $AB = z^n$, then will $\overline{z+z}^n$
 $= z + n z^{n-1} z + n \times \frac{n-1}{2} z^{n-2} z^2 + n \times$
 $\times \frac{n-1}{2} \times \frac{n-2}{3} z^{n-3} z^3$ &c. (And because
 $z^n = AB$, $n z^{n-1} z + n \times \frac{n-1}{2} z^{n-2} z^2 + n \times$
 $\frac{n-1}{2} \times \frac{n-2}{3} z^{n-3} z^3$ &c. $= DC$) $= y = az +$
 $b z^2 + c z^3 + d z^4$ &c. For I have supposed
 $z = x$; but it has been demonstrated before,
that when z is less than any assignable
Quantity ($a = n z^{n-1}$) and z becomes less
than any assignable, when



$$AC = BF$$

when the Line DC moving along the Line AC becomes *Quantitas jamjam evanescens* at the Point A .

If

If $a = nz^{n-1}$, then $bz + cz^2 \&c. = n \times$
 $\times \frac{n-1}{2} z^{n-2} z + n \times \frac{n-1}{2} \times \frac{n-2}{3} z^{n-3} z^2 \&c.$

But $n \times \frac{n-1}{2} z^{n-2} z + n \times \frac{n-1}{2} \times \frac{n-2}{3} z^{n-3} z^2$

$\&c.$ is less than DC . Let it be GH ; and
 let z , in my Language, be less than any
 assignable Quantity; in Sir *Isaac's* let GH
 move to the Point A , and be just vanishing
 there, then will $b = n \times \frac{n-1}{2} z^{n-2}$. And

from hence it will follow $cz = n \times \frac{n-1}{2}$
 $\times \frac{n-2}{3} z^{n-3} z \&c.$ and proceeding in the

same manner $c = n \times \frac{n-1}{2} \times \frac{n-2}{3} z^{n-3}$, $\&c.$

In this Case $n \times \frac{n-1}{2} \times \frac{n-2}{3} z^{n-3}$, $\&c.$ may
 be represented by IK ; and so on in *infini-*
tum you have the Fluxions of Fluxions of
 Fluxions, $\&c.$ of the Ordinate y .

I have been thinking of several Series of
 Questions in Algebra, the Solution of which
 might be express'd in common Language,
 without Algebraical Characters, in order to

O

give

give any Person of common Sense an Idea of this way of thinking. This was certainly the Arithmetical Analysis of the Antients. And these Examples will give a full Idea of all that Reasoning which comes under the Head of modern Algebra, and much more naturally and easily than when the Course of Thought is disguised, as it is by their Letters and Symbols, which make it look like a Sort of Conjuraton, and somewhat different from the ordinary Way of plain Reason.

Take therefore a Series of these Questions: The Questions, when reduced to Equations, will stand thus:

Question 1.

$$\left. \begin{array}{l} x + y = a \\ x = by \end{array} \right\}$$

Question 2.

$$\left. \begin{array}{l} x + y + z = a \\ x + y = bz \\ x = cy \end{array} \right\}$$

Question

Question 3.

$$\left. \begin{aligned} x + y + z + u &= a \\ x + y + z &= bu \\ x + y &= cz \\ x &= dy \end{aligned} \right\}$$

Question 4.

$$\left. \begin{aligned} x + y + z + u + w &= a \\ x + y + z + u &= bw \\ x + y + z &= cu \\ x + y &= dz \\ x &= ey \end{aligned} \right\}$$

Question 5.

$$\left. \begin{aligned} x + y + z + u + w + s &= a \\ x + y + z + u + w &= bs \\ x + y + z + u &= cw \\ x + y + z &= du \\ x + y &= ez \\ x &= fy \end{aligned} \right\}$$

And so on *in infinitum*, *a*, *b*, *c*, *d*, *e*, *f*, &c. standing for known Quantities, the rest for unknown.

These Questions, and their Solution, in common Language, will stand thus.

QUESTION I.

To divide any Number, whatever, into two Parts; so that the first shall be three times the second.

Solution.

Let the Number, to be divided, be an Hundred; then the first and second are equal to an Hundred; but because the first is three times the second, the first and second (which is the same as three times the second, and the second) is four times the second; and, consequently, four times the second is equal to an Hundred: And therefore the second is a fourth Part of an Hundred, that is, Twenty-five. The second, then, being Twenty-five; the first, and Twenty-five, must be an Hundred; that is, the first must want Twenty-five of being an Hundred, and is, therefore, Seventy-five. And let the given Number, which was here an Hundred, be what it will; by the very same way of reasoning it may be divided according to the Condition of the Question.

Q U E.

QUESTION II.

To divide any Number into three Parts, so that the first and second shall be twice the third, and the first three times the second.

Solution.

Let the Number to be divided be Ninety-six; then the first, second, and third, are equal to Ninety-six: And because the first is three times the second, therefore the first and second are equal to four times the second; but the first and second are equal to twice the third; therefore four times the second is equal to twice the third; and, consequently, twice the second is equal to the third: If, then, twice the second is equal to the third; and three times the second is equal to the first; then five times the second is equal to the first and third, and six times the second is equal to the first, second, and third. But the first, second, and third, are equal to Ninety-six; therefore six times the second is equal to Ninety-six; that is, the second is a sixth Part of Ninety-six, or Sixteen; and the first, which is three times the second, is Forty-eight; and the third, which is twice the second, is Thirty-two. The same way
of

of reasoning again holds, let the Number, to be divided, be what it will, &c.

Suppose these Questions propos'd to you, and that after you have reasoned thus with yourself, when you tell the Proposer, that the particular Numbers he has in his Mind are these which you thus find out, he replies and says that they are not the Numbers; and that however your Analysis may hold good in other Cases, it fails here?

It is plain, if general Knowledge is nothing, you have nothing to say to him in Reply.

But if he will allow you, that every Three and One is Four; that all Equals, added to Equals, make equal Sums; and that every two Numbers, equal to a third, are equal to one another; it is plain, he must then allow you to be so far right, in the Solution of the first Question, that the second is a fourth Part of an Hundred, &c.

It is surprising to see what an Infinity of Truth is brought into the Mind by means of those few first Axioms our Algebraists build upon; and how it all comes into the Mind by *Reminiscence*.

I have lately deduced some arithmetical Theorems from arithmetical Principles, which other Mathematicians have drawn from

from Fluxions of Fluxions, &c. and these Theorems fell in with my Design.

I knew, from *Aristotle*, that there was no arithmetical Theorem but might be deduced from arithmetical Principles; and that made me bold; and indeed I was very agreeably surpris'd to see how it turn'd out.

But these Things take up one's Thoughts too much, and to their Power of enslaving is owing the Shallowness of some of our modern Mathematicians, who dare not look up to those Laws of Science by which they ought to direct themselves, in their Synthesis and Analysis. When it is objected to them, that they have no Regard to these Laws; they talk of satisfying the Scruples of those who make Objections, and seem to have very little or no Sense of what I am now speaking of; quite satisfied in their own superior Wisdom.

In every mathematical Question there must be as many Equations as there are unknown Quantities, which Equations have each unknown Quantities involv'd in them on both Sides.

But you have no Knowledge, till you come to an Equation in which there is only one unknown

unknown Quantity on one Side, and one known on the other.

This, as I take it, is but a particular Instance of GENERAL UNIVERSAL ANALYSIS.

For Equations, it considers Propositions; for unknown Quantity, it considers γένν. There is, for Example, one γένος, and that of Science, which γένος is unknown. The Proposition I have to find out, is this :

If I ask, WHAT IS SCIENCE ? I am told, Geometry and Arithmetic. Geometry is Science, then ; and Arithmetic is Science : Geometry, therefore, and Arithmetic, are taught as unknown Things ; and I am to inquire what *this* is, which is the *same* in both.

Now Algebra affords me Rules to find out that which is the same in both Sides of Equations : What Rules, then, does this PHILOSOPHICAL ARITHMETIC afford ? If, in the Terms of both Propositions, there is something the same, and I am to find out what this is ; what have I to do, but to subtract what is different ?

The Rules of Algebra, for Reduction of Equations, are nothing but Addition and Subtraction ; for Multiplication is a repeated Addition, and Division repeated Subtraction.

In the common Algebra, by which Name I mean a general Way of Analysis in Arithmetic and Geometry, we always inquire for *Equality* or *Inequality*, in Things *equal* and *unequal*.

In the PHILOSOPHICAL ALGEBRA we inquire for IDENTITY and DIVERSITY, in Things the *same*, and *different*.

The Mathematician assumes as many Equations as he can reduce from the Condition of his Question.

Does not the PHILOSOPHICAL ARITHMETICIAN do the same? He inquires, for instance, what a * SOPHIST is; he assumes certain Propositions, and proceeds to others, till he comes, at last, to that, as plain and evident, in which the same Thing, common to the Sophist, has some Thing common to some other known Thing; which other known Thing, therefore, has something common to the Sophist.

But how is this ἀκριβεστάτη τῶν ἐπισημῶν? Because by this all Things are judged; by this Reckoning every Thing is estimated, mathematical Subjects themselves. This determines the STANDARD by which all Things are measured; this presents us with the

* Plat. Sophist.

NOHTON; without it we have only $\epsilon\delta\omega\lambda\alpha$ in our Minds, and are in the Condition Man-kind would be in, were there no Arith-metic or Geometry; were all in Number-ing and Measuring to be done by Guess and Fancy.

F I N I S.

ERRATA.

P. 4. l. 1. read *this*.

P. 14. l. 16. read *Virtuosos*.

P. 16. l. 7. for $\frac{8}{6}$ read $\frac{2}{3}$.

P. 136. in the Note, read *ἐναλίγκιον*.

Where the ARE's, MANY's, HAVE-BEEN's, and SHALL-BE's occur, read ARES, MANYs, HAVE-BEENS, and SHALL-BES.

That the Mathematical Papers are so correct as they are, is owing to the Care of a Gentleman who is esteemed to be very skilful in the Subject.

ERRATA

P. 4. l. 1. read *and*
P. 4. l. 16. read *and*
P. 10. l. 7. for *and*
P. 106. in the Note, read *and*
Where the *and*, *have*, *have*, and *shall*
be *and*, *have*, *have*, and *shall*
That the Mathematical Papers are *and* as they are
owing to the Care of a Gentleman who is *and*
to be very *and* in the *and*.

